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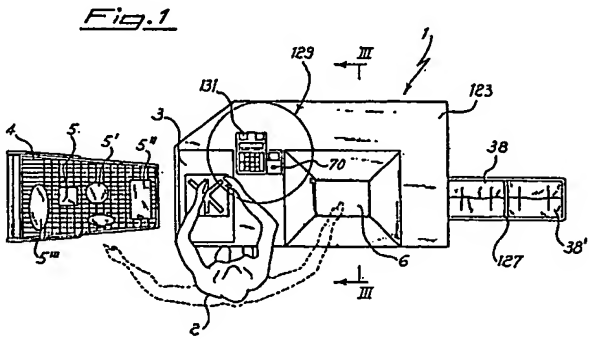
(54) A fully self-service check-out counter incorporating an integral apparatus for on demand manufacturing of custom-sized bags conforming to the volume of articles received therein.

(57) A completely self-service check-out counter for cashier-unattended use and operation includes an laser scanner for automated reading of product identification codes borne by articles purchased, a keyboard for manual entry or article-identifying information, a multiplicity of indicators and signalling devices for instructing actions by the customer, devices for preventing pilferage, fraud and inadverted errors. Check-out counter also comprises manufacturing custom-formed bags on-site at the counter and on demand and, custom-sized to conform to the volume of articles to be packed in the bags. Customers completing the scanning and packing of purchased articles proceed to a central cashier to pay for their purchases.

Fig.1



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Description

A FULLY SELF-SERVICE CHECK-OUT COUNTER INCORPORATING AN INTEGRAL APPARATUS FOR ON DEMAND MANUFACTURING OF CUSTO-SIZED BAGS CONFORMING TO THE VOLUME OF ARTICLES RECEIVED THEREIN

The present invention relates to check-out counter used, for example, in supermarkets and other sales establishments, and which are adapted for fully self-service and cashier-unattended use by a customer. It is more particularly directed to self-service check-out counters which integrally incorporate apparatus for on-site and on-demand manufacturing of flaccid or flexible bags, preferably custom-sized to conform to the volume of articles packed therein, for advantageously increasing the efficiency with which customers proceed through the check-out procedure and significant decreasing merchant costs.

Current practice at supermarkets is to have a cashier-operator at each check-out register, either by automated scanner or direct manual keyboard entry, or both, the prices of the various articles being purchased by a customer. The cashier, an assistant, or the customer then places the articles or goods in a bag which has generally been preformed most commonly either of plastic material or of paper. Similar practices and attendant problems exist at department stores and other retail establishments.

The design and operation of current, conventional check-out counters presents what is probably the single most significant impediment to the efficient movement of customers through and out of sales establishments such, for example, as supermarkets. The cashier at each check-out counter individually picks up and examines each item, enters item identification or pricing information into the register, and returns the item to the counter. When entry of all goods being purchased has been completed, the items are again picked up from the counter and packed in preformed bags usually by the cashier, sometimes by or with the assistance of a separate bagging employee and/or the customer. Usually, the cashier is unable to begin to process the next customer's intended purchases until packing of the preceding customer's goods is complete and the filled or partly filled bags have been removed from the check-out counter. Although the recent introduction and rapidly spreading use of laser-based universal product code scanning devices has somewhat increased the rate at which customers are able to advance through check-out counters, the cashier-operator must still pickup or grip each item, properly orient the item and slide it past the scanning window, and then replace it on the counter for subsequent packing in the preformed bags which must themselves be individually unfolded and set up on the counter for receiving the purchased articles. These repetitive operations are both awkward and time consuming, resulting in highly inefficient processing of customers who have already completed their selection of items to be purchased and want only to pay for their purchases and leave the store. They are in addition extremely labor intensive and, therefore, expensive for the merchant to implement in that a store must staff each and every check-out counter with an individual cashier-operator and, in some cases, with an additional bagging employee as well.

Moreover, in order to properly accomodate the great majority of customer purchases, the preformed bags are typically sized with sufficiently large dimensions for holding a substantial number of articles. In actual use, however, the volume of articles packed in the bags varies greatly from bag to bag resulting in customer difficulty and inconvenience in manipulating a combination of filled and partially filled opentopped bags, in substantial waste of materials and in further increased costs to the merchant.

The prior art discloses a variety of efforts to increase the efficiency of check-out operations. For example, U.S. Patent No. 4,676,343 discloses a check-out counter arranged for being directly operated by the customer and thus intended to obviate the need for the merchant to supply separate cashiers for each counter or check-out station. The customer individually passes each item to be purchased over a laser scanner located at one end of the counter, following which the item is returned to the counter and carried, by a moving conveyor belt, through a security tunnel and then to the opposite end of the counter for subsequent bagging. While passing through the security tunnel the item is scanned a second time to verify the identity of the item being purchased and thereby prevent inadvertent or fraudulent customer conduct during the check-out procedure. When scanning and subsequent packing in preformed bags of all of the articles being purchased has been completed, the customer proceeds to a central cashier where the goods are paid for and the check-out transaction ends.

Although the arrangement of the above-mentioned U.S. patent should reduce the merchant's costs by minimizing the number of cashier-employees required, it has no effect on the various other sources of check-out inefficiency previously noted. Indeed, in addition to having to handle each item at least twice, once to pass the article across the scanner and again to pack the item in a bag, the conveyor-carried passage of each item through the security tunnel and the rescanning of the product as a preventative to pilferage and honest mistake is likely to increase, rather that decrease, the time that each customer spends in the entire check-out procedure. And the use of preformed bags remains both an inconvenience for customers and a source of added and difficult-to-control costs to the merchant.

It is accordingly the desideratum of the invention to provide a check-out counter apparatus and method in which customers may proceed through the check-out procedure in a substantially expedited manner.

It is a particular object of the invention to provide

such a check-out counter apparatus and method which requires only minimal handling of articles being purchased.

It is another object of the invention to provide such a check-out counter apparatus and method which is operated entirely by the customer and does not therefore require the presence or assistance of a cashier or other store employee.

It is a further object of the invention to provide such a check-out counter apparatus and method in which articles being purchased are packed in bags custom formed on-site at the counter and on-demand as required for receiving the purchased articles.

Yet another object of the invention is to provide such a check-out counter apparatus and method in which bags manufactured on-site and on-demand at the counter are custom-sized to conform to the volume of articles purchased and to be received in the bags.

A further object of the invention is to provide such a check-out counter apparatus and method which incorporates sufficient safeguards to prevent deliberate fraud and attempts at pilferage as well as inadvertent mistakes by customers using the apparatus and practicing the method of the invention.

These and other advantages of the method and apparatus according to the present invention will be evident to those skilled in the art from the following detailed description of some embodiments thereof with reference to the attached drawings wherein:

FIGURE 1 is a plan view of a supermarket check-out counter in accordance with one illustrative form of the present invention;

FIGURE 2 is a side elevational view of a supermarket check-out counter in the same illustrative form of Fig. 1;

FIGURE 3 is a partially sectioned side elevational view taken along lines III-III of Fig. 1;

FIGURE 4 is a partially sectioned front view of the apparatus looking from the left in Fig. 3;

FIGURE 5 isa sectional view taken along the lines V-V of Fig. 3;

FIGURE 6 is a sectional view taken along the lines VI-VI of Fig. 4;

FIGURES 7 and 8 are enlarged sectional views of feeding and transverse cutting means of the invention shown during cutting and feeding, and after cut and feeding respectively;

FIGURES 9 to 13 are partial schematic perspective views of the apparatus during the various phases of the process of filling and forming a custom-sized bag in accordance with one embodiment of the invention;

FIGURE 14 is a perspective view partly in elevation and partly in section, of a device for forming bags with handles;

FIGURE 15 is an enlarged sectional view of the handle forming means shown in Fig. 14;

FIGURES 16 and 17 are perspective views in elevation of the bag forming device at different times during the formation of the bag with handles;

FIGURE 18 is a perspective view in elevation of a longitudinal heat-sealing device suitable for use as a part of the invention;

FIGURE 19 is a perspective elevational sectional view of a sealing head used in the device shown in Fig. 18;

FIGURE 20 is a side view, in elevation and partly broken away, of the check-out counter of Fig. 1;

FIGURE 21 is an enlarged plan view of the information entry and display pannel of the check-out counter of Fig. 1;

FIGURE 22 is an enlarged plan view of a shutter reciprocating device for use in the self-service check-out counter of Fig. 1;

FIGURE 23 is a view, partly broken away, of the shutter reciprocating device of Fig. 22 taken along the lines III-III of Fig. 1;

FIGURE 24 is a block diagram showing the connection of the bag forming device and associated elements of the self-service check-out counter to a controller and to the store central computer; and

FIGURE 25 is a diagrammatic flow-chart detailing the steps in the operation of the self-service check-out counter of Fig. 1 and the method of this embodiment of the invention.

In Figs. 1 and 2 it can be seen the customer 2 which is identifying one by one on the scanner 3 the articles 5, 5', etc. he has purchased and brougt up to counter 1 with the shopping cart 4. If the identification has been satisfactory performed, client 2 receives an allowing sign through the green light 131 and/or acoustic or other convenient sign, so that he can introduce the identified article in the feeding opening 6 defined on counter 1. The identified articles fall through the opening 6 into a bag forming device incorporated in the counter 1, which receives through the opening 6 one by one the articles purchased and identified by client 2. By means of a push button 70, preferably placed on the top of counter 1, the customer can start the operation of the apparatus which automatically packs in on-site manufactured plastic bags the articles introduced into the opening 6 by himself. The dimensions and number of the bags depend from the quantity and volume of the articles purchased by client 2 in the supermarket. On the top surface of counter 1 there are other pushbuttons and indicators which will be detailed described hereinafter. On the side of counter 1 there is a roller conveyor 127 on which remain the bags 38, 38' etc. containing the articles purchased, identified and packed by the customer. The customer can at the end pick-up the full bags and go to the central cash for paying his purchases.

Referring now to Figs. 3 to 19 some embodiments of the bag forming device incorporated in counter 1 will be described.

In Figs. 3 and 4 it is shown an embodiment of the apparatus for forming the bag which is incorporated in counter 1 and is integral part thereof with its frame essentially consisting of vertical plates 9, 10 and 11 which support and enclose all the parts of the apparatus. This comprises a roll 12 of continuous flat film sheet-material 13 placed on a pair of support and drive rollers 14, 14' which, when driven by a drive motor (not shown), rotate to turn roll 12 and thus

cause film 13 to unwind from the roll 12. Continuous sheet-material 13 may be thermoplastic material or other suitable flat continuous sealable material, such as plasticized paper.

Film 13 is drawn from roll 12 and is guided around jockey rollers 15, 15' and intermediate tensioning roller 15", the latter of which is movably mounted on a constant tension frame 16 as is well known in the art. After passing over jockey roller 15', film 13 passes along a pair of guiding planes or surfaces 18, 18' disposed in a generally V-shaped orientation, passing under plane or surface 18, through gap 18" between the planes, over plane 18' and into the interior of a generally quadran gular hollow former 17 in such a way that, as will hereinafter become clear, the longitudinal film edges 19, 19' overlap to form a continuous tubular wrapper 20. More particularly, planes 18, 18' which are disposed with an opening or gap defined between their respective lower edges, each progressively tapers in its transverse dimension or width in the direction of film movement. Thus, plane 18 gradually narrows from its top-disposed edge adjacent roller 15', which edge is dimensioned at least as wide as the width of the film, to its lower edge. And plane 18' similarly narrows from its lower edge, which is of substantially the same width as the adjacent lower edge of plane 18, to its uppermost edge which is disposed adjacent former 17 and has substantialy the same width as the former. This arrangement facilitates the translation of film 13 from its initially flat condition to a tubular wrapper 20 within former 17. It should nevertheless be recognized that alternate arrangements, such as a suitably dimensioned roller mounted at the approximate location of the gap defined between planes 18, 18', may be substituted for the V-disposed planes 18, 18' to implement the same function.

Former 17 is located immediately under the top surface 123 of counter 1 and in register with opening 6 through which articles 5, 5' etc. to be packed are introduced. Opening 6 is internally provided with collar 8 which facilitates the introduction of the articles in the apparatus and prevents that they hit on film 13 before thetubular wrapper 20 is formed.

A motor 21, through a chain 22 connected to the motor. rotates roll 25 which is in contact with the tubular wrapper 20. Roller 25 carries at an end an elicoidal gear 23 which rotates roll 26 and, at the opposite end a conical gear which rotates roll 26' which is parallel to and has the same dimensions of roller 26. Roller 26 carries at its opposite ends an elicoidal gear 23' and roller 26' carries at its opposite ends a conical gear 24', the said gears rotate roller 26" which is parallel to and has the same dimensions of roller 25. All the said rollers rotate in such a way that tubular wrapper 20 is downwardly drawn as flat film 13 is unwinded from roller 12 and proceeds within former 17.

During the continuous downward movement of film 13 within former 17 it is bent in a tubular form and its overlapped edges 19 and 19' are longitudinally sealed by a welding head 27 which is moved close to the said edges by operation of an electromagnet 28. These components 27 and 28 are part of the sealing device 29 which will decribed with more detail hereinafter. The closed tubular wrapper 20 thereby obtained is subsequently transformed into a bag 30 by a transverse heat seal which forms the bottom of the bag as will soon become clear.

Referring now to Figs. 3 and 5, the bag forming apparatus further includes a loading platform 31 for supporting the bottom of bag 30 as articles to be packed are introduced by thecashier or customer into the counter opening 6. Loading platform 31, which will be described with more detail hereinfater, is arranged for vertical movement from a fully raised position immediately below former 17 and collar 8 to a fully lowered position adjacent the bottom of the machine frame, the latter position being shown in Fig. 3. A bracket 34 which is fixed to and supports loading platform 31 is connected to a lead screw 33 engaged with a rotatable threaded bar 32 to which rotative motion is selectively applied by an electric motor (not shown). Thus, depending upon the direction of rotation of threaded bar 32, lead screw 33 is moved along bar 32 to raise or lower platform 31 as will soon become evident, loading platform 31 which supports the bottom bag 30 being formed during its descent may also be halted at any height or level during the operation of the apparatus as a function for example of the volume or weight of the articles introduced into bag 30.

In order to distribute the load platform 31 and to insure a smooth passage for the platform, a pair of guide bars 35 are provided adjacent threaded bar 32 (Fig. 4). Two unthreaded apertures in lead screw 33 receive the guide bars with a close sliding fit. Of course, other guide means may additionally or alternatively be employed as a matter of design choice. A transverse sealing means for closing a full bag 38 and for concurrently creating the bottom of a bag 30 next being formed is illustrated in Figs. 7 and 8.The transverse sealing means essentially comprises a pair of reciprocating elements 36, 37 which are elongated and extended transversally to the direction of travel of the bag forming material in which are relatively reciprocable movable into mutually abutting engagement while the tubular wrapper 20 is interposed between them. Element 37 carries a pair of transversely elongated welding plates 39, 40 separated by and located immediately adjacent a notch 41. A transverse blade 42, which is preferably but not necessary serrated or jagged, fixed to reciprocating element 36 projects outwardly beyond element 36 in the direction of element 37 in register with notch 41.

As reciprocating element 36, 37 are relatively moved into mutual engagement with interposed tubular wrapper 20, the wrapper is transversely heat sealed along two spaced apart lines defined by welding plates 39 and 40. Thus, lower welding plate 40 effects heats sealed closure of the top of the bag 38 already filled with articles, while upper welding plate 39 heat seals closed that portion of continuous tubular wrapper 20 above bag 38 to thereby create the bottom of the next bag 30 being formed. At the same time, blade 42 performs a transverse cut between the upper and the lower heat seal closures as the blade enters notch 41 whereby the full bag 38

is detached of the overhanging bag 30 on which a bottom closure has cuncurrently been created.

A platform 43 for temporarily supporting the bottom of the bag 30 being formed is arranged for substantially horizontal movement between a first position above reciprocating element 36, 37 and immediately under the bottom of the bag 30 (Figs. 6, 13) and a second position laterally removed from said first position (Fig. 10). This movement of platform 43 is effected by selective directional rotation of a pair of lead screws 45 along which nuts 44 fixed to opposite ends of platform 43 are threadely engaged. Lead screws 45 carry on their end gears 46 and are rotated by operation of directional motor 49 through a gear 48 on the motor shaft and a timing or toothed belt or chain 47 connecting the gears 46 and 48. Platform 43 is brought to and attains its first position immediately under the bottom of the bag 30 being formed when, upon detachment of the full bag 38 supported by loading platform 31, reciprocating elements 36, 37 begin to move apart so that the tubular wrapper is no longer gripped therebetween. The presence of platform 43, in its first position, thereby permits the introduction of articles into the new bag 30 being formed even before the full and sealed bag 38 has been moved to a discharge or ejection station by platform 31 and platform 31 is thereafter returned to its bags supporting position. Thus, platform 43 enables the entire loading process to be accelerated although, if desired, platform 43 may be omitted in which case the loading of the new bag 30 will await the return of platform 31.

The bags formed by the apparatus are preferably gusseted or pleated. The device for gusseting the bags may be seen, for example in Figs. 6 and 12, where two pairs of folders 50, 51 and 52, 53 are disposed for pivotally reciprocating movement about pins 50, 55 along two horizontal planes respectively above and below reciprocating elements 36, 37. Inward movement of the folders from their Fig. 12 extreme outer position carries their free ends into engagement with the opposite sides of the now tubularly formed wrapper 20 for the purpose of forming a pleat or gusset on each of the opposite sides of the bag 30 being formed and of a filled bag 38 which is about to be sealed. Folders, 50, 51, 52 and 53 are driven by any suitable reciprocating drive means (not shown) in timed relation with the various other operating elements of the apparatus as will hereinafter be described.

Figs. 3 and 5 show also the means for ejecting the full bag 38, which comprises a motor 57 whose shaft has a lead screw and threadedly engages a lead screw nut 59 to which a bracket 60 is connected driven along a substantially horizontal plane, guided by elongated rods 58, 58' which are disposed parallel to the shaft of the above-mentioned motor. Attached to bracket 60 there is a pusher 61 for shifting the full bag 38, which has been sealed and detached from the bag being formed 30, from the fully lowered loading platform 31 to a discharge or ejection platform 63, and from here on the outside of counter through the discharge opening 7 until a rollers conveyor 127. The shifting of bag 38 takes place between opposed lateral walls 71, 71' of the apparatus inside the counter 1. In the cases when it is desirable that the ejection opening 7 is placed on the top surface of counter 1 instead of its lower side, th discharge platform 63 can be arranged for vertically reciprocating movement up to the ejection opening 7 defined in the top surface of counter 1. This will permit a full bag 38 to be easily picked up and removed by the customer. According to such an arrangement, the discharge platform raising and lowering means includes a bracket 64 secured to the bottom of platform 63 and fixed to a lead screw nut 65 threadedly engaged for vertical movement along a rotatable lead screw 67. Depending on the direction of rotation of lead screw 67 discharge platform 63 will move up or down between its fully lowered position and the raised position. A pair of guide rods 66, 66' parallel to lead screw 67 and slidably journalled through lead screw nut 65 provide an enhanced guidance for the lead screw and for the movement of the platform 63.

In Fig. 3 it is shown also the device for detecting the level reached by the articles inside the bag. Such a device essentially comprises two sensor arrays 68, 69 which are horizontally positioned and relatively aligned externally of the opposite sidewalls of former 17 at the upper portion of the former and are positioned below reciprocating elements 36, 37. Each of the sensors array pairs may, for example, comprise conventional infra-red optical transmitter-receivers which emit and are sensitive to the receipt of low frequency infra-red emissions capable of penetrating films, whether or not transparent, of the type used for material 13 from which bags are formed by the apparatus of the invention. The infra-red rays are, on the other end obscured by and will not fully pass through the relatively solid articles packed in the bags 30. Thus, each of the apparent low-sensor array pair 68, 69 forms an electronic or optical curtain capable of detecting the passage of the relatively solid articles to be packed through the substantailly planar zone defined by each pair of sensors.

The bag forming apparatus of the invention is also provided with means for determining the position or relative position of loading platform 31 along the vertically reciprocated paths between its fully raised position seen in Fig. 9 and the fully lowered position seen in Fig. 13. It will be recalled that platform 31 is reciprocated through motor driven rotation of vertically disposed lead screw 32 as, for example, by an end mounted gear 115. In the disclosed form of the invention, the platform position determining means comprises a disc 116 mounted on and rotatable with a threaded bar 32, and a sensor 117 for detecting rotations of disc 116 (Fig. 3). The combination of disc 116 and sensor 117 may take any of variety of forms such, for example, as an optically readable marking or delineation of the disc for detection by the optical sensor 117 with each rotation of threaded bar 32 and disc 116 or, in another arrangement, a structural projection from a cam-like disc 116 for actuating engagement with a mechanical switch or sensor 117 as the disc rotates with lead screw 32. By counting the number of rotations carried out by lead screw 32

as a platform 31 is raised and lowered, changes in the position or height of the platform can be fairly precisely determined in conjunction with the platform distance known to be transversed during each rotation of lead screw 32 and, given the initial position or height of platform 31, its final position following each subsequent movement will likewise be known. Obviously numerous alternative and/or supplemental arrangements may be employed to monitor or track the position of and amount of vertical movement undergone by loading platform 31.

The apparatus according to the present invention is preferably provided with an apparatus to monitor the weight of a bag 30 being formed as articles are placed or packed therein. For this purpose, a flat plate-type sensor 118 (Fig. 3) may be carried on loading platform 31 so that a bag 30, during the placement of articles therein, is directly supported on th weight sensor 118 which is thus interposed between platform 31 and the bag 30. Sensor 118 may comprise any convenient and conventional apparatus capable of generating an output related to the weight of an object supported thereon to the controller of the inventive bag forming and check-out counter system.

The various functional elements and assemblies of the bag forming apparatus are connected to a controller (not shown). Because the controller, which may take any of a variety of mechanical, electromechanical and/or electric and electronic is well-known in the art, is deemed to be within the mechanical ability of one skilled in the art having knowledge of this disclosure.

The operation of the bag forming apparatus may be best understood with reference to Figs. from 9 to 13 which sequentially illustrate the formation and completion of a custom-sized bag. In Fig. 9 is illustrated as articles 5, 5′ etc. are introduced in the bag being formed 30 whose bottom is supported by loading platform 31. It is of course preferred that goods be so placed in the bag as to most fully and efficiently exploit the available space inside it. The bag forming machine permits and facilitates an intelligent and efficient distribution of articles placed inside the bag being formed because during the introduction of articles in the bag 30 this is stopped being stopped the supporting platform 31. When the space within the bag has been filled, but there remain additional goods to be packed, it is obviously necessary to increase the dimensions of the bag being formed 30 and that may be obtained by actuation of a manual control or pushbutton 70 provided on the top surface of counter 1. This control. which may be manually actuated by the customer itself, is connected to a wellknown electronic system not illustrated. This control which may be manually actuated by the customer itself, is connected to the apparatus controller and, when operated. causes a predetermined rotation of rollers 14, 14′ to further unwind film 13 from about roll 12. Rollers 25, 26, 26′ and 26″ are also actuated to advance the film downwardly within former 17, thereby extending the length of tubular wrapper 20 as the longitudinal edges 19, 19′ of the advancing film 13 are heat-sealed together. At the same time, threaded bar 32 is rotated to lower the loading platform 31 by a preset distanc as for example 24 cm, until the bottom of the bag 30 which is supported on platform 31 reaches a position immediately below lower sensor arrays 69 (Fig. 10).

During and following the completion of this first descent of loading platform 31 the loading of articles into the bag 30 continues until either there remain no additional goods to be packed or all of the available space within the bag has been filled. In either case, the customer once again manually actuates control 70 causing loading platform 31 to resume its descent as seen in Fig. 11. This second descent of platform 31 is automatically halted when all of the articles packed in bag 30 descend below lower arrays 69 and the infra-red rays are thus no longer blocked by articles packed within the bag. At this point, then, the maximum level reached by the goods packed in the bag 30 is positioned immediately below the level of lower sensor arrays 69.

In any event, the descent of loading platform 31 may also be halted automatically by a determination that the bag has been loaded with goods to a height which would otherwise result in a bag larger than the maximum size bag formable by the apparatus. This feature is implemented by monitoring the output of top sensor arrays 68 when, during the descent of loading platform 31, the platform reaches the distance from the top arrays equal to the maximum predetermined height that a bag formed by the apparatus may have. When platform 31 has reached this point in its descent and top arrays 68 continue to detect the presence of articles between them, further descent of platform 31 is halted and a signal, such as an audible and/or visible alarm, is generated to alert the operator that the bag contains an excessive volume of goods. The operator must then remove a quantity of articles sufficient to clear the area between the top arrays 68 and, once done, donward movement of platform 31 resumes. As previously indicated , the descent of the platform is automatically halted when the topmost articles in bag 30 pass below lower array 69 and the sensors of the lower arrays are thereby once more illuminated.

However, in the event that all of the articles to be packed have been placed and fit within the bag 30 while loading platform 31 remains in its uppermost (Fig. 9) position, it is not, of course, necessary to perform the second phase of loading during and following subsequent descent of platform 31 to its secondary position (Fig. 10). Under these circumstances, the customer manually actuated or depresses pushbutton 70 twice in succession whereby platform 31 descends not by the preset amount normally traveled but rather through a free run which stops as soon as the topmost goods in the bag 30 clear the lower sensor arrays 69 and are disposed immediately below said sensor arrays.

When lower sensor arrays 69 have been reilluminated determining the stop of the platform 31 and of the over-hanging full bag 38, this is ready to be sealed.

The sealing is performed by transversal welding and this operation is illustrated in Figs. 12 and 13. In

the moment when the lower sensor arrays 69 are reilluminated, they causes that reciprocating elements 36, 37 are relatively moved into heat sealing engagement so that the top of the full bag 38 is sealed by welding plate 40. At the same time, welding plate 39 creates the bottom-defining the closure seal of the next bag 30 above full bag 38 and blade 42 cuts the film between the two seals thereby detaching the full bag 38 from the new bag 30 being formed.

Referring now to Fig. 13, following simultaneous heat-sealing closure of the full bag 38 and creation of the bottom of a new bag 30, and the cutting of film 20 therebetween by cutting edges 42 to separate the two bags 38 and 30, the reciprocating elements 36, 37 separate slightly so as to free the known closure of the top edge of the full bag 38. At this time rotation is once again imparted to lead screw 32 so that platform 31 resumes its descent until reaching its lowermost position which is coplanar with ejection platform 63, and, if employed, with adjacent fixed planar surfaces 62.

The reciprocated separation of the heat sealing elements 36, 37 in addition to freeing the top edge of now completed bag 38, also releases the newly formed bottom seal of the new bag 30 on continuous tubular wrapper 20. As the elements 36, 37 begin to separate, temporary support platform 43 begins its lateral translation from the position shown in Fig. 12 to that illustrated in Fig. 13 above reciprocating elements 36, 37 and immediately below the now heat-sealed and closed bottom of the new bag 30 being formed. The bottom of this new bag 30 may thus rest on and be supported on platform 43 so that the placement of goods in the new bag may begin immediately, i.e. before ascending return of loading platform 31 and completion of the previous operation cycle relating to the now filled and sealed bag 38. When both loading platform 31 and ejection platform 63 are in their lowermost positions and at the same level, motor 57 is operated to move pusher 61 rightward from its Fig. 13 position and thereby shift completed bag 38 laterally through opening 7 up to roller conveyor 127 so that it can be easily picked up by the customer.

Loading platform 31 returns then to its initial position (Fig. 9) and thereby takes the place of support platform 43 which has been moved laterally and thereby returned to its initial position (Fig. 15). During the ascending return movement of loading platform 31, gusset formers or folders 50, 51, 52, 53 are in their open or outwardly rotated condition and reciprocating element 36, 37 are likewise fully separated. At this time also pusher 61 is returned to its initial position in preparation for the bag filling, sealing and discharge phases of the next operation cycle of the bag forming apparatus.

The embodiment of the bag forming apparatus of the invention thus far disclosed additionally preferentially incorporates, both structurally and in its operation, several means for assuring both the safety of the operator and the continued integrity of the customer and of various operating portions of the machine. Also some functional parts of the machine also perform supplementary safety functions. For example sensor arrays 68, 69 are employed also to prevent injury to the customer when he inadvertedly puts his hands in opening 6 during operative motion of reciprocating elements 36, 37 and the support platform 43. For this purpose when the hand of the customer is detected between arrays 68, these discontinue motion of elements 36, 37 or platform 43, or direction of such a motion is reversed to further minimize the risk of personal injury.

The sensor arrays 68, 69 are also used to prevent possible damage to the reciprocating elements 36, 37 should these elements be moved together into heat-sealing relation with the film while one or more articles are disposed between them. For this purpose, the lower sensor array 69 before allowing the approach of elements 36, 37 controls with electronic means (not described here for simplicity) that the total volume of articles passed through lower sensor array 69 exactly corresponds to the one of the articles which passed through the upper sensor array 68. Only in the event that both volumes are the same, the approach of reciprocating elements 36, 37 is allowed. In all the other cases when the total volume of the articles detected by the upper sensor array 68 is bigger than the one detected by the lower sensor array 69, platform 31 is lowered by an additional distance corresponding to that difference before reciprocating elements are permitted to begin their film sealing approach.

According to another embodiment of the invention the bag forming apparatus can be equippes with a device for forming handles in the bag containing the articles so that it can be easily picked up and transported by the customer. Such a device, which will be fully described with reference to the manufacture of a bag with handles 38', comprises the elements 36', 37' which are a modification of the elements 36, 37.

As it is shown in Figs. 14 and 15, the reciprocating element 37' carries, in addition to the transverse blade 42 heretofore described, two longitudinally-oriented (e.g. vertical) elongated blades 80 located below the heat seal 40 carried by element 37'. The reciprocating element 36' correspondingly carries two blade receiving spaces or grooves 81, only one of which is visible in the figures. Two pair of compression springs 82, 83 urge reciprocating element 37' against element 36' during the heat sealing phase. The two longitudinal blades 80 are joined together at their lower ends by a substantially horizontal perforating die or blade 84. The blades 80 are positioned in correspondence of the gussets 85 formed by the free ends of folders 50, 51, 52, 53 on each side of the full bag 38'. Thus, as the compression springs 82, 83 press the reciprocating elements 36', 37' against the interposed tubular film wrapper 20, the blades 80 are driven through the front and rear faces of bag 38' and, consequently, through two layers of film 13 to thus sever said layers along the two lines defined by blades 80. According to a further embodiment the blades 80 are positioned so that they contact the face of bag 38' within the lateral extent of the gussets 85. In this alternate case approach of reciprocating elements 36', 37'

drives each of blades 80 through one of the gusseted portion of bag 38' and, consequently, through four layers of film 13 to form a strip or bridge of film between the bag handles and the overlying protective envelope. This results, as will become evident, in a closed bag structure from which the chance of inadvertent spillage of the bag's contents is substantially minimized. Each of the longitudinal blades 80 is also preferably provided with a projecting portion 86 which extends outwardly from element 37' by a distance sufficient so that, when reciprocating elements 36', 37' initially separate following heat sealing contact with the film, the projecting portions 86 continue to bridge the gap between the slightly separated elements 36', 37'. The purpose of projections 86 will become apparent hereinafter.

Formation of the handled bag 38' will be better understood with reference to Figs. 16 and 17. As previously described in connection with other embodiments and aspects of the present invention, as reciprocating elements 36', 37' are moved together toward and into engagement with the interposed tubular film wrapper 20, inward rotation of folders 50, 52 and 51, 53 create the pleats or gussets 85 in the new bag 30 and the filled bag 38', respectively. Upon contact of element 36', 37' with the interposed film, the heat sealing plates 39, 40 on element 36' form the heat-sealed bottom closure of the new bag 30 and top closure of filled bag 38, respectively, and blade 42 produces a transverse cut through the tubular wrapper between the two heat seals so as to separate the completed bag 38 from the bag 30 in formation which is a still part of the continuous tubular film wrapper 20 thereabove. In addition, in the present modified embodiment of the invention, the elongated blades 80 create longitudinal cuts 87, 87' inwardly spaced from the gusseted sides of the bag and perforating die 84 produces a line of punched slits or perforations 88 through the front and rear faces of the bag film.

Following heat sealing and blades cutting contact of reciprocating elements 36', 37' with the interposed bag film the supports separates slightly and platform 31 resumes its downward motion to carry the completed bag 38' to a position for subsequent ejection or discharge from the apparatus. As bag 38' moves downward with descending platform 31, the projecting portions 86 of the blades 80 continue to cut the film of the full bag 38 longitudinally through the top heat seal closure of the bag. These additional cuts through the top closing seal of the bag, in conjunction of the longitudinal cuts 87, 87' produced by the blades 80, define and complete the handles 89. 89' along opposite sides of the filled and completed bag 38'.

It should be especially pointed out that the top of the bag 38' between the longitudinal handle-defining cuts 87. 87' remains integral with the bag and forms an envelope 92 which is effective to prevent accidental loss or outpouring of the goods contained in the bag 38' during the transport thereof. This protective envelope 92 may nevertheless be readily removed for emptying the bag 38'. Said removal is rendered easy by the perforation 88 produced by the perforating die 84. Once emptied, bag 38' may be readily reused as traditional bag .

Fig. 18 shows the details of the welding devices which in its whole is indicated by 29 in Fig. 3 and is adapted to the sealing of the overlapped edges 19, 19' of the film 13 when this is formed into a tubular wrapper 20 within the interior of former 17. The heat sealing unit 29 is supported by a bracket 94 which is joined by four connectors 93 to a plate 9 which is comprised in the frame of the machine. Connectors 93 have preferably vibration damping grommets or rubber rings mounted thereon in order to minimize mechanical disturban ce to the remainder of the apparatus. The welding head 27 is carried on one end of a rocker arm 101 which is mounted about a vertical shaft 96 and in which a groove 100 is defined at its end opposite head 27. A lever 95 mounted at one of its ends for pivotal movement about shaft 96 is connected at its opposite end to the shaft 102 of electromagnet 28, preferably rigidly joined to the frame of the machine. A return torsion spring 97 disposed about shaft 96 between the shaft head and lever 95 urges the lever clockwise into contact with the end of the electromagnet shaft 102. The shaft of an electric motor 98 fixed to and mounted on lever 95 carries a cam 99 disposed in the groove 100 of rocker arm 101.

When the electromagnet 28 is actuated, lever 95 and, through its cammed connection, rocker arm 101 are driven through a counterclockwise rotation about shaft 96 against the urging of torsion spring 97. As rocker arm 101 so rotates, it carries welding head 27 toward the superposed edges 19, 19' of the film 13.

When on the other hand electromagnet 28 is not actuated, return spring 97 places a clockwise urgency on lever 95 and rocker arm 101 to carry and maintain welding head 27 out of contact of the superimposed edges of the film. This inactive or non-heat sealing portion of the welding head 27 permits facilitated manual feeding of film 13 into the interior of former 17 to be readily carried out when, for example, it is necessary to replace an exhausted film roll 12 supported on rollers 14, 14'.

When electromagnet 28 is actuated the heat sealing unit 29 is moved into working position in which welding head approaches the superposed film edges 19, 19' which are in contact with a plate 103 resiliently mounted on collar 8 by leaf springs 104. Simultaneously welding head 27 start to hammer the superposed edges 19, 19' of the tubular wrapper which vertically moves toward the bottom along the plate 103 and in such a way the head carries out its welding action. The hammering action of the welding head 27 on plate 103 is effected by the operation of motor 98 which, through rotation of motor-driven cam 99 in groove 100, causes high frequency oscillation (as for example at 50 to 80 Hertz) of rocker arm 101 about shaft 98. In an alternative arrangement, the combination of motor 98, cam 99 and rocker arm groove 100 may be replaced with an electromagnet suitably acting on rocker arm 101 or on a similar means.

As illustrated in Fig. 19, welding head 27 includes a pair of electrical strap resistors 105, 105' in series

connection through a connector 106 and in electrical communication at terminals 107, 107′ through a cable 108 connected to a power source (not shown). Insulated pushers 109, 109′ which are mounted on compression springs 110, 110′ (of which only 110′ is shown in the figure) compensate for terminal expansion and assure that proper tensioning of the strap resistors is continuously achieved. The strap resistors overlay spacers 111, 112 which insulate the resistors from the metal casing of the welding head 27.

Heat is supplied to the overlayed edge portion of film 13 to be joined by conduction through the flattened front surfaces 113, 113′ of strap resistors 105, 105′. Proper performance of the heat sealing operation requires close or narrow control of the heat sealing temperatures of resistors 105, 105′. Such control can be effected in any known manner as with an electronic control system which monitors the temperature value of the resistors by monitoring their resistance at terminals 107, 107′. The monitored resistance is compared with a predetermined reference resistance value corresponding to the desired sealing temperature and the electronic control system operates to maintain the difference between the measured resistance and the reference value within an acceptable range by controlling the electric power supplied to the strap resistors 105, 105′.

From the foregoing it should be apparent that the preferred method of joining the superposed edges 19, 19′ of tubular film wrapper 20 is effected by the combination of two simultaneous actions having thermal and mechanical characteristics i.e. the localized softening of the film which is caused by heat supplied through electrical strap resistors 105, 105′ as well as the high frequency hammering (50-80 Hz) of the softened area of the film. The intermittency of the hammering action also allows an easy flow of the tube-formed film under the welding head 27.

Referring now to Fig. 20 may be seen as the bag forming apparatus is disposed with the interior of counter 120 so that former 17 and internal collar 8 are located immediately below and in register with counter opening 6 whereby articles 5, 5′ inserted through opening 6 are received within a bag 30 being custom-formed by apparatus. The partially fragmented view of Fig. 20 depicts a bag 30 being formed within counter the bag being supported on loading platform 31 and weight sensor 118. The inclu sion of weight sensor 118, or of a functionally equivalent arrangement for detecting the weight and changes in the weight of a bag 30 supported on loading platform 31, is considered central to this embodiment of the invention. Moreover, and although not specifically illustrated in such detail, those skilled in the art will appreciate that in this particular form of the check-out counter of the invention former 17 and collar 8 of the bag forming apparatus do not extend through opening 6 in the manner illustrated in Fig. 3, but, rather, terminate sufficiently below opening 6 so to avoid interfering contact with movable shutter 124. Both structure and operation of movable shutter 124 will be described hereinafter.

The bags 38, 38′ shown in Fig. 20 have different sizes as to illustrate that they were custom-sized for receiving or the articles carried by the customer with the shopping cart 4 which is now empty. Filled bags 38, 38′ are provided with handles and rest on roll conveyor 127 until subsequent removal by the customer. Roll conveyor 127 may comprise an extension of or from fixed bag support surface 63 (Fig. 11) along which completed bags 38 are advanced by pusher 61 from loading platform 31 to roll conveyor 127, or may in the alternative extend all the way from and adjacent to the fully lowered position of loading platform 31 in which case fixed surface 63 is omitted. The provision of sidewalls or rails 128 of appropriate height along conveyor 127 will help to maintain the bags 38 in an upright orientation during and following their discharge from the counter interior.

Check-out counter 1 further includes an information entry and display panel 129, best seen in the enlarged detail of Fig. 21. Panel 129 has a keyboard 130 to enable manual entry of product identifying and/or pricing information when, for example, scanner 3 is unable to read the product code or the article does not bear such a code. Panel 129 also includes illuminatable indicators 131, 132 labelled "OK" and "WAIT", or colored green and red respectively, and pushbutton switches 133, 134 and 70 labelled "START", "FINISHED" and "BAG", respectively. Of course, all of the above-mentioned designations and/or colorations in respect of panel 129 are solely by way of example to facilitate an understanding of the structure and operation of the inventive check-counter 1.

With continued reference to Fig. 21, panel 129 further includes a paper tape printer (not shown) for preparing a printed tape record 136 of the various articles purchased by the customer. A "HELP" pushbutton switch 137 is depressable when the customer requires special assistance or instructions in the use and operation of the check-out counter apparatus. Such assistance may be provided by actuation of recorded messages conveyed to the customer through a loudspeaker 138 or by signalling a supervising employee of the store who may then respond through the loudspeaker. Messages, customer prompts and additional assistance may also be provided on a character display 139 which can be alternatively take the form of a cathode ray tube or other known character and/or graphics display device.

The apparatus for reciprocating shutter 124 between its first position closing the counter opening 6 and its second position remote from the opening for permitt ing the insertion of articles 5, 5′ into a bag 30 being formed by apparatus 120 may be constructed in any suitable manner. One illustrative form of shutter reciprocating device is shown, by way of example in Figs. 22 and 23 and will now be described.

Referring at first to Fig. 22 in which the shutter is seen in both its first (broken line) and second (solid line) positions, shutter 124 comprises a substantially rectangular plate formed of any convenient material,

such as plastic or metal having elongated tabs 140, 140' extending outwardly from its opposite edges. Tabs 140, 140' are connected to axial bearings 141, 141' which are slidable along respective guide rods 142, 142'. Guide rods 142, 142' may be supported for example on vertical plates 9, 10 (Fig. 3) or the like which form a part of the frame of the bag forming apparatus. An extension 143 on tab 140 is secured by bolts 144 to a toothed belt 145 trained about a drive pulley 146 and an idler pulley 147. Idler pulley 147 is supported for freewheeling rotation about a shaft mounted to a fixed support member 148.

A motor 149 is bidirectionally operable for moving pulley 146 and thereby effecting reciprocated movement of shutter 124. More particularly, the shaft of motor 149 carries loosely journaled drive pulley 146 and a single plate clutch 150 which is keyed to the motor shaft and is urged into engagement with drive pulley 146 by a spring 151. Rotation of the motor shaft is thereby transmitted through clutch 150 to drive pulley 146 and toothed belt 145 which in turn carries shutter 124 between its first and second positions by its bolt- secured connection to the belt at tab extension 143. The clutch force is selectively variable by adjustment of a nut 168 to vary the urgency with which clutch 151 is driven against drive pulley 146 by spring 151; this ability to vary the clutch force enables selective adjustment of the force with which shutter 124 is reciprocated so as to avoid injury to a customer whose hand or other body part may extend into or through opening 6 as shutter 124 is returned from its second to its first position closing counter opening 6.

Fig. 24 diagrammatically illustrates the electrical and electronic connection of the bag forming apparatus 125 to a processor or controller 152, which may for example be implemented by a microprocessor-based computer, and to the central computer 153 or other main information processing and/or data storage apparatus of the supermarket or store in which the check-out counter 1 is located. The central computer will typically contain in its memory or storage devices data relating to the entire store inventory by, for example, product identification, weight and price. The exact construction of controller 152 is considered to be within the ability of those skilled in the art utilizing conventional components and devices and its details are accordingly omitted from this disclosure. Laser scanner 3 and manual data entry keyboard 130 are also connected to controller 152.

The operation and use of the ckeck-out counter 120 may now be understood with specific reference to the flow chart of Fig. 25. It should at the outset be said again that the check-out counter 1 is designed and contructed for entirely self-service operation by the customer and thus does not require the presence of a cashier or other store employee to either oversee or assist in its use. Therefore when the customer 2 has completed selection of articles 5, 5' to be purchased he brings them to check-out counter 1, typically with the articles usually stored or disposed in a cart or basket 4 or the like (Fig. 1). In step 154 in the flow chart, article identification and/or pricing information is entered into the check-out system. More particularly with respect to the disclosed apparatus, the customer first initiates the operation of scanner 3 by depressing pushbutton switch 133 following which the customer begins to select and grasp articles 5, 5' from cart 4 and to manually transport them, one by one, across the face of the scanner to automatically input the universal product identication codes which they bear. Pricing and/or item identification data of any article unable to be automatically scanned in this manner can be entered manually by way of keyboard 130. Either immediately after depression of pushbutton 133 to start scanner 3, which is generally preferred, or after scanning of the first article, the customer depresses pushbutton 70 activating the bag forming apparatus 125 which begins the manufacture of a bag 30 as heretofore described. Operation of pushbuttons 133 and 135 is required only once, i.e. when a new customer has proceeded to counter 1 and is ready to begin the check-out procedure.

The data either read by scanner 3 or manually entered through keyboard 130 is verified in steps 155 and 156. Verification consists of conforming a successful scanning or manual data entry operation, and comparing the entered data with that residing in the central computer 153 to confirm that the article is in fact one that is sold by the store. If a problem is detected, the data must be reentered and the customer is instructed, for example through illuminating of indicator 132 and/or by way of a message appearing on display 139 or emitted from loudspeaker 138, to rescan or manually reenter the data. Assuming, on the other hand, that the data verification test of step 156 is successful, indicator 131 may be illuminated to so inform the customer that motor 149 is operated to move shutter 124 from its first to its second position remote from counter opening 6 (step 157). The customer may then place the article that has been scanned and verified through opening 6 and into the bag 30 being custom-formed within the interior of check-out counter 1 by apparatus 125.

It should be pointed out that at this juncture that there has been only minimal handling of the article 5 as it has moved from shopping cart 4 to bag 30. The article has been picked up from cart 4, carried across the face of scanner 3 and placed into the bag 30 by the same person (the customer 2) in a single motion and without any need to release, regrasp or reorient the article from start to finish. The result is a substantial time savings, particularly when multiplied over the generally substantial number of items purchased by each customer and the numerous customers passing through each check-out station, for the customer and vastly increased efficiency (and correspondingly decreased costs) for the merchant.

When the successfully scanned article 5 is placed through opening 6 into bag 30, its passage is detected in step 158 by the optical or electronic curtain defined by upper sensor arrays 68. In step 159 the level of the loading platform 31, on which bag 30 is supported, is adjusted if necessary to clear sensors 68. That is, if sensors 68 remain at least partly obscured after the most recent article has

been placed into bag 30, platform 31 is caused to descend until the optical curtain of sensors 68 is once again unobstructed. It is generally contemplated that, in this particular embodiment of the invention, platform 31 is adapted to descend by small, incremental amounts as articles are placed into the bag 30. Nevertheless the descent of platform 31 as articles are inserted into bag 30 may alternatively be arranged to take place in a limited number of larger increments as previously disclosed, as a matter of design choice. In any event, in step 160 the condition of sensors 68 is tested to determine whether the sensors have been cleared by a further descent (if required) of the loading platform.

Assuming for the moment that the optical curtain of sensors 68 is or has become (through descent of platform 31) unobstructed, the positive outcomes of the test of step 160 leads to step 161 in which the weight of the article just added to bag 30 is determined. This determination is made by calculating the difference in the weights of bag 30 before and after the addition of the last-packed article, those weights being sensed by or in conjunction with weight sensor 118. The weight of the article packed in bag 30, as so calculated, is then compared (step 162) with the known or actual weight of the article which is, for example, stored in the central computer 153 of the supermarket or store. A determination that the product scanned by the customer and identified in the store records is the same one that was placed into bag 30 requires that the results of the comparison of step 162 yield a weight difference not higher than an acceptable tolerance of predetermined magnitude which is related, primarily but not exclusively, to the accuracy of sensor 118. Whether that weight difference falls within the allowable tolerance or range is determined in step 163.

If the difference between the measured and stored (actual) weights of the article is within the allowed tolerance, information such as an identification and the price of the article are printed on paper tape 136 (step 164) and the supermarket records are updated (step 165) to record, for example, the purchase of that item. Shutter 124 is then returned from its second to its first position closing counter opening 6 (step 166) by operation of motor 149 and the apparatus is thus ready to begin a new check-out cycle commencing with step 154 in Fig. 25.

Returning now to the test of flow chart step 163, if the difference between the measured and stored weights of the last-packed article 5 is not within acceptable tolerance, the customer 2 is instructed in step 167, as by illumination of indicator 132 and/or an appropriate message on display 139 or through loudspeaker 138, to remove from bag 30 the last item placed therein. It should be recognized that the failure of the weight difference tolerance test of step 163 can result from a variety of circumstances. The most obvious of course is intentional efforts by the customer to defraud by scanning one item but then packing another, more expensive one, in bag 30. It is also possible however that the customer has innocently and inadvertently interchanged two articles which were scanned in rapid succession and, since proper opertion of check-out counter 1 requires that the articles packed at any given moment be the same one most recently scanned, this will result in rejection of the last-packed article. In addition, the article selected for purchase by the customer could be damaged, defective or irregular and therefore should not be sold by the store. In any event, in step 168 the weight of bag 30 is then rechecked, using weight sensor 118 to verify that the last-packed article has been removed and, when it has been removed from the bag, shutter 124 is returned from its second to its first position closing the counter opening 6 (step 169). All identifications of the removed item are removed from the listing of articles purchased by the customer in step 170 and the apparatus is once again ready to scan the next article and begin another article check-out cycle (step 154).

The third and final alternative situation concerning the operation of check-out counter 1 of the invention begins when the results of the test of step 160 indicate that the optical curtain defined by upper sensor arrays 68 remains obstructed after the last-packed article has been added to bag 30 and loading platform 31 has reached its maximally lowered position. This is an indication that custom-formed bag 30 has been expanded to its maximum allowable height and, therefore, that the last-packed article cannot be accomodated in the bag. Consequently in step 171 the customer is instructed, by illumination of indicator 132 and/or a message on display 139 or through loudspeaker 138, to remove the last-packed article from the bag. The weight of bag is then rechecked (step 172) to verify that the last-packed article has been removed and, if it has been determined that the item is no longer in the bag (step 173), the shutter is moved from its second to its first position to cover and close the counter opening 6 (step 174). With the opening 6 closed so as to prevent any part of the customer's body from interfering with or being injured by the operation of bag forming apparatus 125, filled bag 30 is sealed closed or otherwise completed as previously described, formation of a new bag 30 is begun and the completed bag 38 is detached from the tubular web of film material and is discharged from the interior of counter 1 along roll conveyor 127 (step 175).

With the bottom seal of a new bag 30 formed, the bag is ready to receive articles for packing therein and, consequently, shutter 124 is again moved from its first to its second position by operation of motor 149 to open counter opening 6 (step 176). The customer is then instructed in step 177, by illumination of indicator 131, by a visible message on display 139 and/or by an oral message emitted through loudspeaker 138, to repack the article 5 that had to be removed from the previous, now completed bag 38. When that article is inserted into the new bag 30, its entry is detected as the optical curtain of sensor arrays 68 is broken (step 158) and the operating cycle of the apparatus continues from that point as previously described.

When all of the articles 5, 5' being purchased by

customer 2 have been scanned (or information relating to those items has been manually entered through keyboard 130) and have been packed in bags custom-formed by apparatus, the customer depresses pushbutton switch 134 to indicate that no additional articles remain to be checked out. Actuation of switch 134 causes the operation of scanner 3 to be stopped, the current bag 30 to be sealed closed or completed and discharged on roll conveyor 127 from the interior of the counter 1, the cost of all of the articles purchased to be totalled and the printing of the paper tape record 136 of the customer's purchases to be completed. The customer then proceeds to a central cashier (not shown) with the paper tape and, preferably, with the bags 38 containing the articles purchased and pays the total amount due to such cashier. After paying for the goods, the customer leaves the store with the bags 38 of packed articles 5, 5'.

The self-service check-out counter 1 of the invention thus advantageously enables the realization of significant reductions in the amount of time spent by each customer in proceeding through the check-out process and in the costs to the merchant for otherwise staffing each and every check-out counter in the store with a cashier. A not insubstantial factor in reducing the time required for each customer to complete the check-out process is the pairing of customer scanning of the articles being purchased with the on-site and custom-sized manufacture of bags at the check-out counter. Nevertheless, those skilled in the art will readily appreciate that significant self-service check-out efficiency can still be realized where the bags 30 formed on-site at the counter 1 are not custom-sized conform to the volume of articles purchased but, rather, are all formed to several predetermined sizes or even to only a single size. Such a modification is accordingly within the scope and contemplation of the invention.

Indeed, the on-site manufacture of bags at any check-out counter, either self-service or cashier attended, results in substantial savings in the time required to process each customer. Is within the contemplation of the invention also the modification of the self-service check-out counter disclosed in U.S. Patent No. 4,676,343 to incorporate an on-site bag forming apparatus such, for example, as those described and taught in the above preceding patent. The manner of combining any of the several check-out counter embodiments of the above U.S. patent with on-site bag forming apparatus in accordance with the present invention will be apparent to those skilled in the art and having knowledge of the teachings of this disclosure.

Thus, the various embodiments of processes, apparatus and articles hereinabove described in accordance with the invention provide for the combination of a fully-self-service check-out counter and the automated packaging of widely varied volumes of goods in custom-sized bags, manufactured on-site and on-demand in accordance with the particular volume of goods to be packed. Each bag may have a height continuously or step-wise variable between a minimum and a maximum -- as for example between about 10 to 15 cm and about 50 cm -- depending upon the particular installation and selectable design criteria at the option of the user.

Although there have been shown and described numerous novel features of the invention as applied to various preferred and/or illustrative embodiments thereof, it will be understood that various omissions and substitutions and changes in the form and details of the devices illustrated and in their operation, and in the methods and processes described, may be made without departing from the spirit of the invention. Indeed, since there are so many novel features, many may be omitted if desired without departing from the invention, and the described structures are generally preferred, but not required, various modifications being possible without departing from the invention.

Claims

1. Apparatus for permitting a customer to check-out one or more purchased articles self-service, characterized by the fact of comprising:
means (3, 130) for identifying each of said articles (5, 5') and for pointing out a characteristic of the identified article;
means (125) for forming bags on-site on demand for containing said articles;
means (118) for determining the actual characteristic of the article after the latter has been identified by identifying means and before said bag for said article has been completed by said bag forming means; and
means (152) for comparing the characteristic of the article taken off by identifying means with the effective characteristic of the identified article to confirm the identity of the article bagged in a bag formed by bag forming apparatus.

2. Apparatus in accordance with claim 1, characterized in that article identifying means comprises code reader means for automated detection of codes borne by articles being purchased by the customer as the articles are moved across a portion of said reader means.

3. Apparatus in accordance with claim 2, characterized in that said code reader means comprises a laser scanner (3).

4. Apparatus in accordance with claim 2, characterized in that said article identifying means further comprises a keyboard (130) for manual entry of article identifying information.

5. Apparatus in accordance with claim 1, characte rized in that the bags formed by bag forming means are formed of a flaccid material.

6. Apparatus in accordance with claim 1, characterized in that the comparing means compares the characteristic of each identified article with the characteristic of the article immediately after it has been received by bag forming means.

7. Apparatus in accordance with claim 6, characterized in that said characteristic is article weight.

8. Apparatus in accordance with claim 6, characterized in that said characteristic is article weight and comparing means compares the identifying weight of each article after the article has been placed into a bag being formed.

9. Apparatus in accordance with claim 1, characterized in that said bag forming means includes an article-receiving portion (6) through which articles to be packed (5, 5') in a bag (30) formed by bag forming means (125) are inserted, article identifying means (3, 130) and article-receiving portion of the bag forming means being so juxtaposed that following input by the customer through the identification means, the article can be placed by the customer directly into the article-receiving portion of the bag forming means in a single, substantially continuous motion.

10. Apparatus in accordance with claim 1, characterized by the fact of comprising also shutter means (124) for preventing placement of an article into bag forming means until the customer has the input relating to the article through said indentifying means.

11. Apparatus in accordance with claim 10, characterized in that the shutter means (124) comprises a member (143) movable between a first position preventing access of articles to the bag forming means and a second position permitting such access.

12. Apparatus in accordance with claim 11, characterized by the fact of further comprising a counter (1), the bag forming means (125) being disposed within the interior of said counter which has an opening (6) substantially adjacent to the bag forming means into which articles to be packed in bags are placed, said shutter means (124) being disposed so as to close said opening in said first position and to leave said opening substantially unobstructed in said second position.

13. Apparatus in accordance with claim 1, characterized in that bag forming means forms bags which are custom-sized to conform to the volume of articles packed in the bags.

14. Apparatus in accordance with claim 1, characterized in that the bag forming means forms bags from longitudinally continuous, flaccid sheet material (13) having spaced apart longitudinal edges.

15. Apparatus in accordance with claim 14, characterized in that bag forming means includes a longitudinally extending hollow former means (17) for advancing the sheet material through the bag forming means in a downward direction, the former means shaping the sheet into a peripherally continuous configuration with longitudinal sheet edges (19, 19') in sealable relation, said apparatus further comprising a counter (1) and passage means (6) of articles into a bag in formation, said peripherally continuous configured sheet being in register with the passage means.

16. Apparatus in accordance with claim 15, characterized in that the bag forming means further comprises means (29) for sealingly connecting the longitudinal edges (19, 19') of the sheet to form a peripherally continuous wrapper (20).

17. Apparatus in accordance with claim 16, characterized in that the bag forming means further comprises sealing means (36, 37) below the former means (17) for sealingly closing the bottom of said wrapper (20) to form the bottom of a bag.

18. Apparatus in accordance with claim 17, characterized in that the bag forming means further comprises support means (31) for the bottom of the bag being formed and means for moving said support means downwardly to move the top of said bag at the same level with the sealing means for bag-closing sealing thereby.

19. Apparatus in accordance with claim 1, characterized in that the bag forming means is operable for on-demand and on-site manufacturing of custom-sized article-packed bags substantially conforming in size to the volume of articles packed therein, comprising:

means (17, 31) for longitudinally feeding a longitudinally extending tubular wrapper (20) of flaccid film material (13);

first means (37, 40) for transversely sealing the film (13) at a first location along the tubular wrapper (20) to create a closed bottom to the bag being formed (30) for the receipt of articles (5, 5') to be packed therein, the top of said bag in formation remaining open for the receipt of said article;

means (42) for transversely cutting the film (13) at a second location along the tubular wrapper (20) above the transverse seal to define the ultimate height of the bag after that has received a certain volume of articles and to separate the articles-containing bag (38) from the longitudinally advancing tubular wrapper (20); and

means for selecting said second location including means (68, 69) for determining said volume of articles received in the bag being formed (30) and for longitudinally advancing the tubular wrapper (20) to place said second location along the tubular wrapper on a line defining a length of wrapper sufficient to accomodate said volume of articles.

20. Apparatus in accordance with claim 19, characterized in that the bag forming means (125) further comprises second means (39, 40) for transversely sealing the film near said second location to close the top of the bag for preventing the unintended loss of packed articles from within the bag.

21. Apparatus in accordance with claim 20, characterized in that the forming means forther comprises means for forming a pair of spaced apart handles (89, 89') unitarily with the tubular wrapper (20) at the top of said bag (30) and for defining a protective envelope (92) intermediate said handles to facilitate retention of articles packed in the bag.

22. Apparatus in accordance with claim 21, characterized in that bag forming means further comprises means (84) for perforating the tubular wrapper in the area of said protective envelope (92) for facilitating the opening of said envelope and gain access to the articles packed in said bag.

23. Apparatus in accordance with claim 19, characterized in that the volume determining and tubular wrapper advancing means further comprises sensor means (68, 69) for detecting the uppermost level of received articles most remote from the bottom of the bag being formed (30) and means for advancing the tubular wrapper to define the top of the bag (38) at a predetermined distance along said tubular wrapper (20) beyond the determined uppermost level of goods.

24. Apparatus in accordance with claim 19, characterized by the fact of comprising also a counter (1) within which bags (30) are formed by bag forming apparatus (125) as well as means (6, 63, 127) for discharging a completed bag (38) from the counter (1) for being removed by customer.

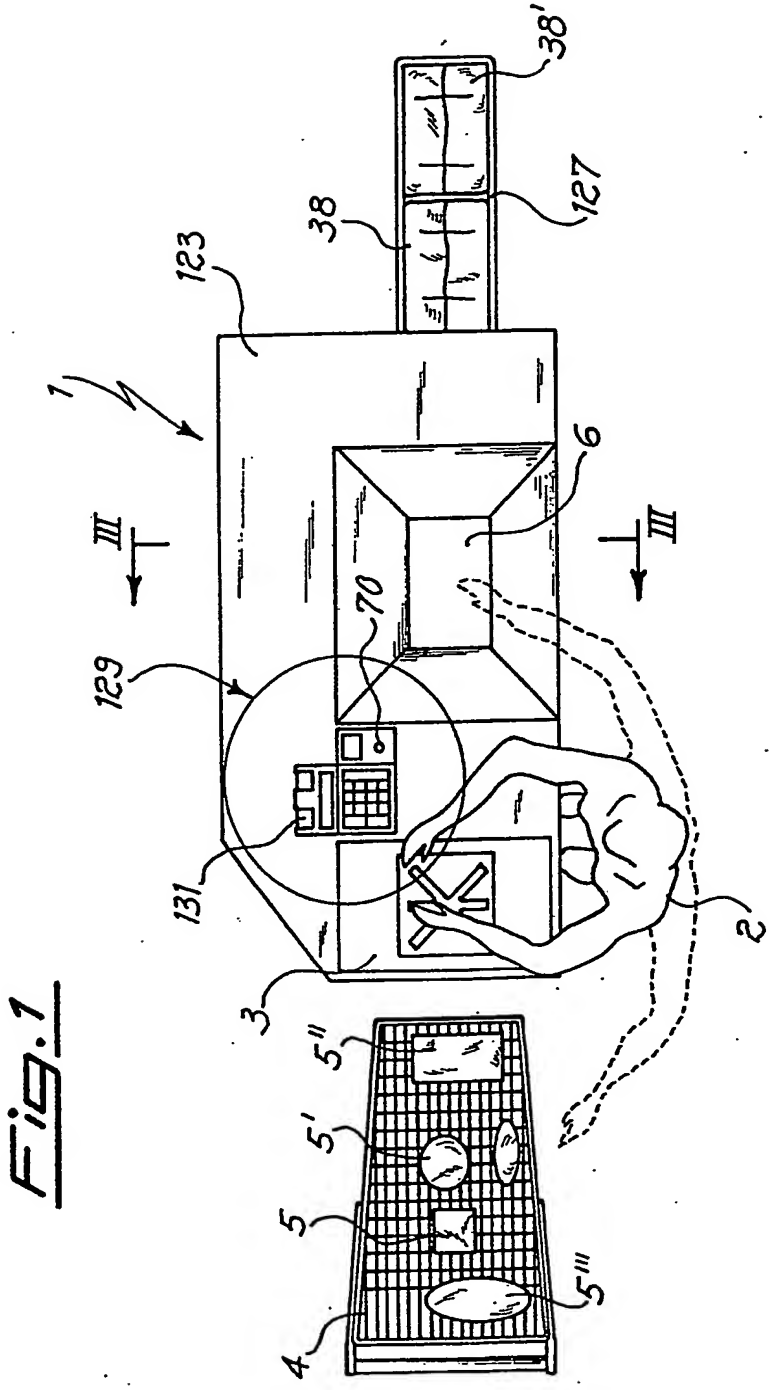


Fig.1

Fig.2

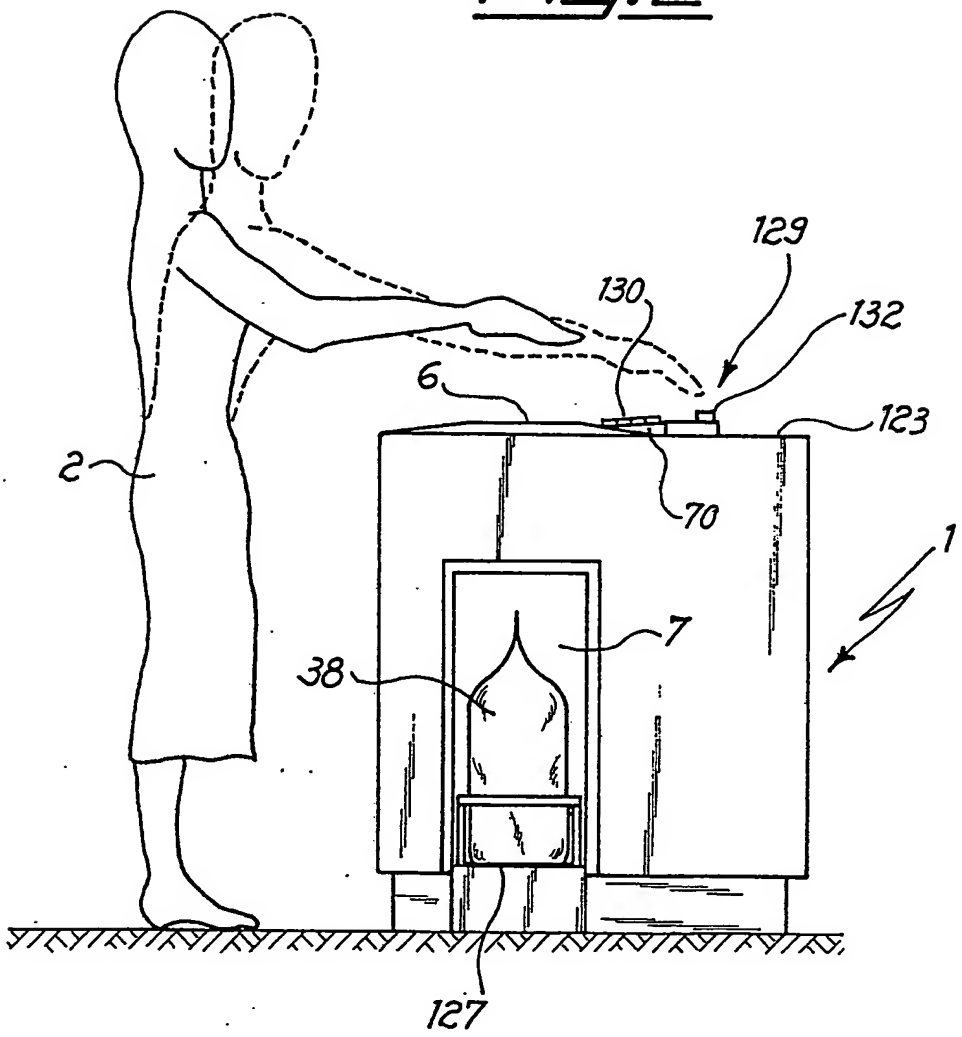


Fig. 3

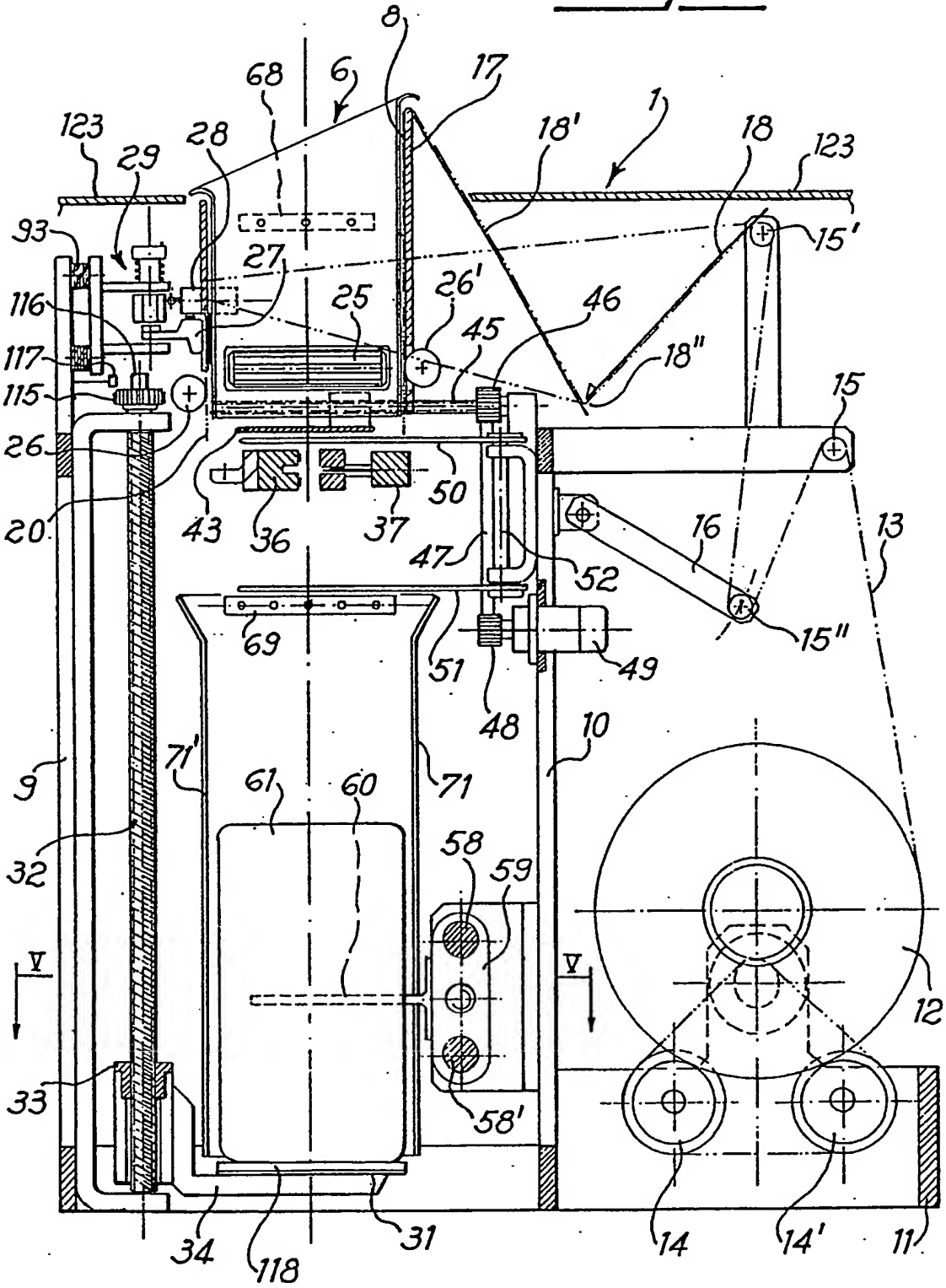

8
68
6
17
1
123
29
28
18'
18
123
93
15'
27
26'
116
25
46
45
18"
117
115
15
26
50
20
43
36
37
47
52
16
13
69
15"
51
49
48
10
9
71'
61
60
71
32
58
59
V
V
12
33
58'
34
118
31
14
14'
11

Fig.4

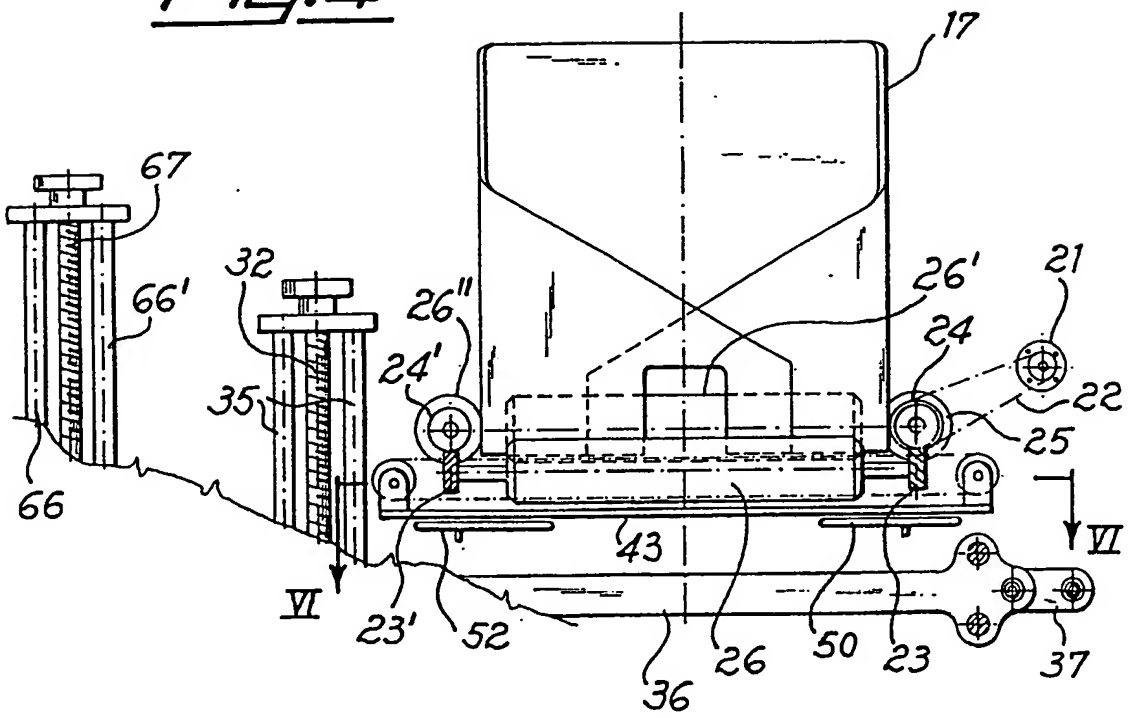

17
67
66'
32
26"
24'
35
26'
21
24
22
25
66
VI
VI
43
23'
52
36
26
50
23
37

Fig.5

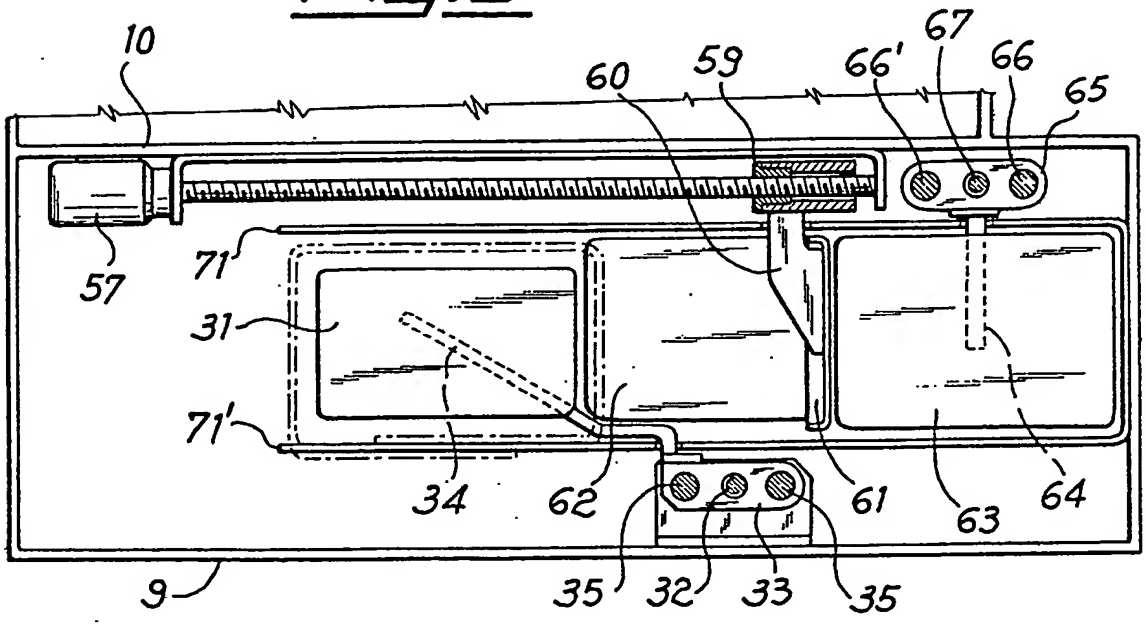

10
60
59
66'
67
66
65
57
71
31
71'
34
62
61
63
64
9
35
32
33
35

Fig. 6

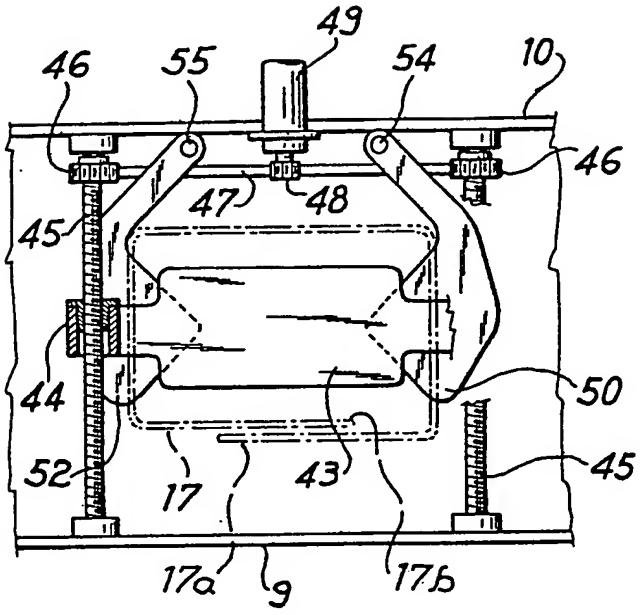


Fig. 7

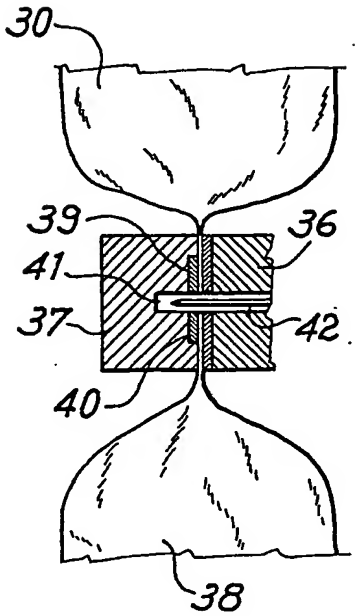


Fig. 8

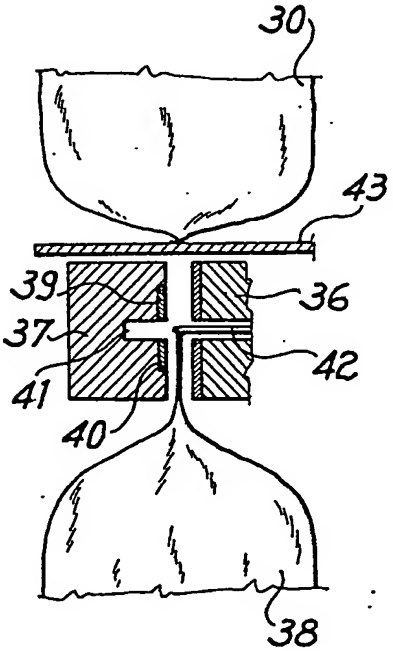


Fig. 9

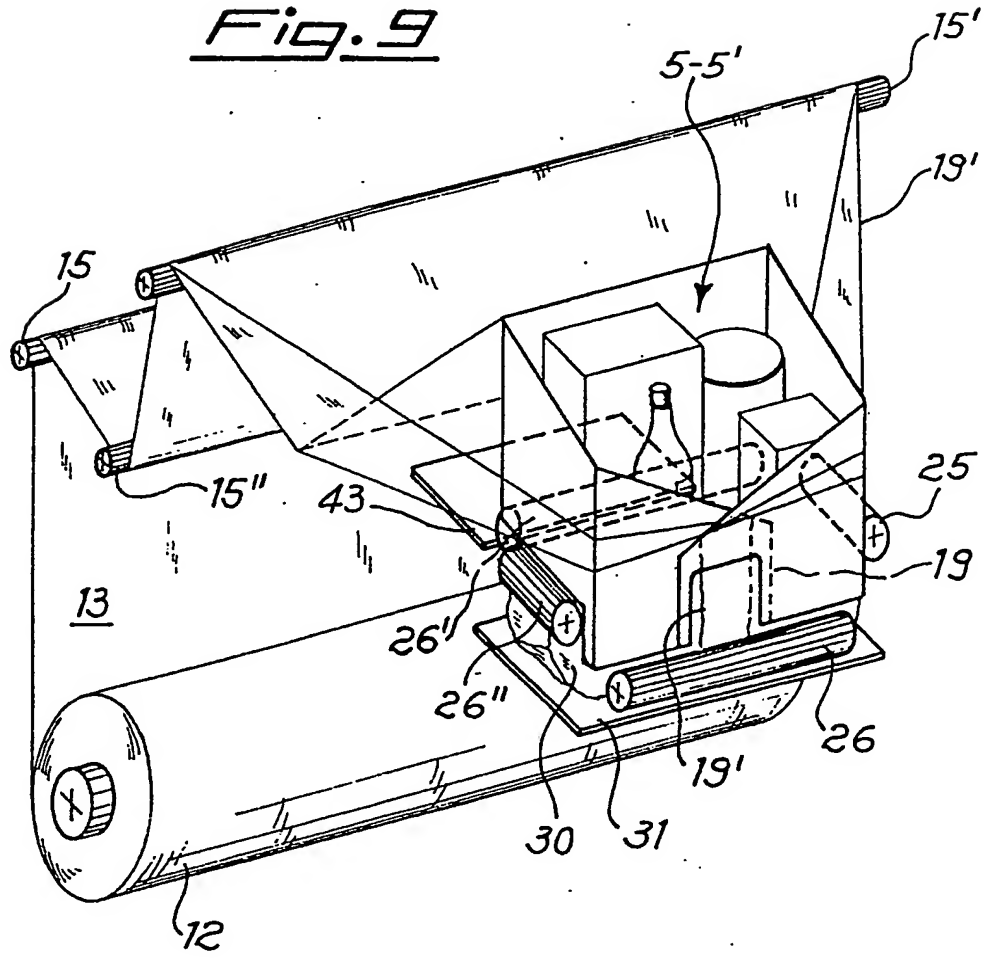


Fig.10

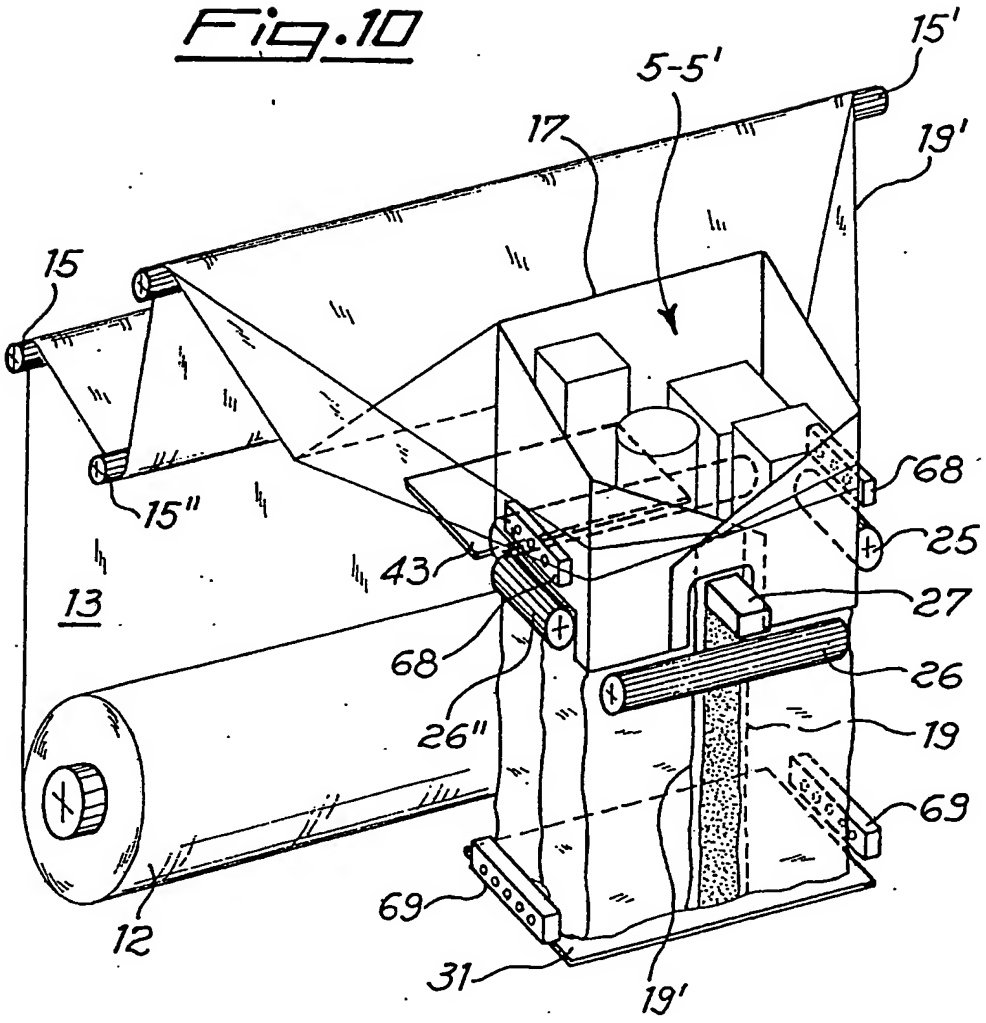


Fig.11

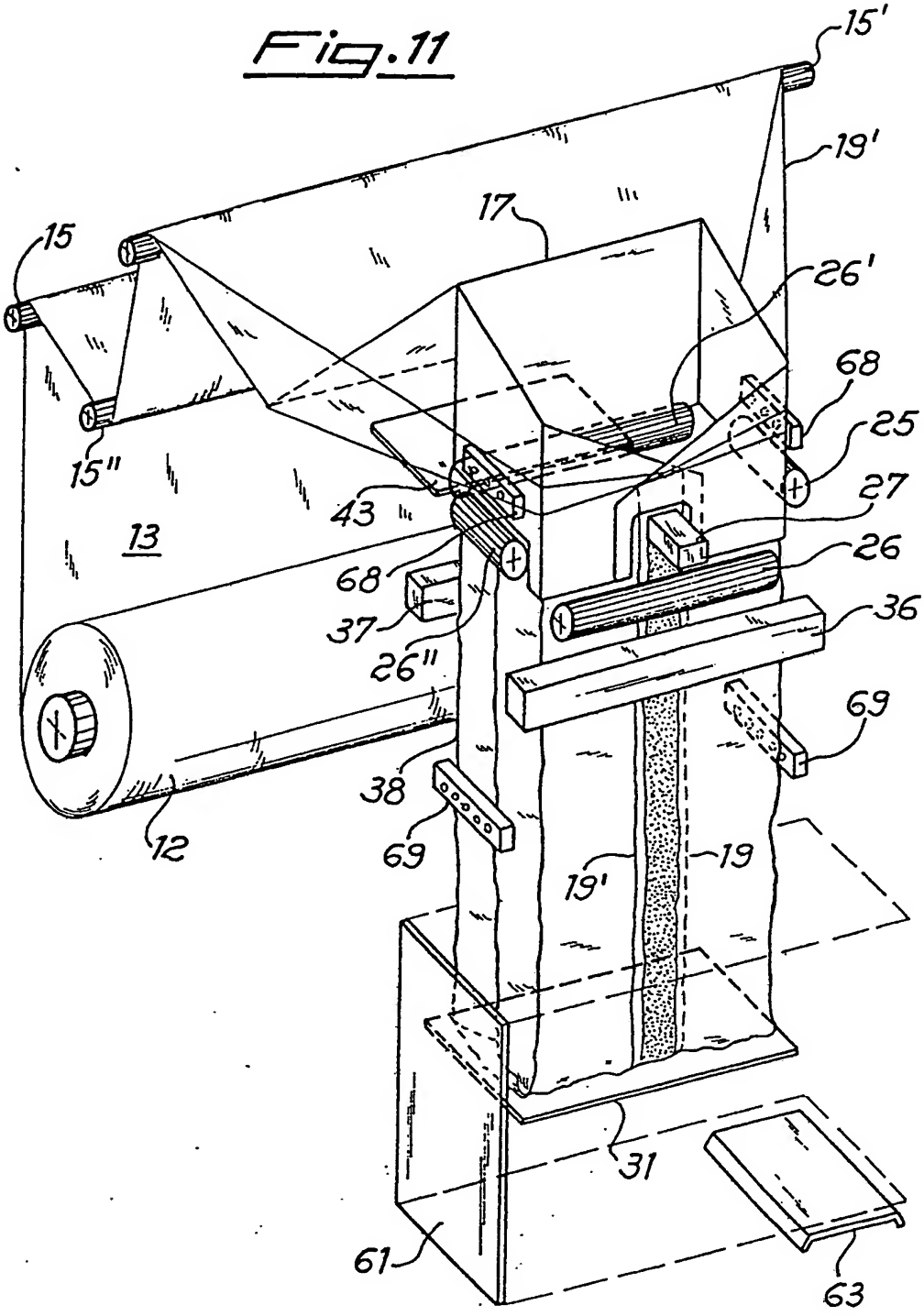

15'
19'
17
15
26'
68
25
15"
27
43
13
26
68
36
37
26"
69
38
69
19'
19
31
61
63
12

Fig.12

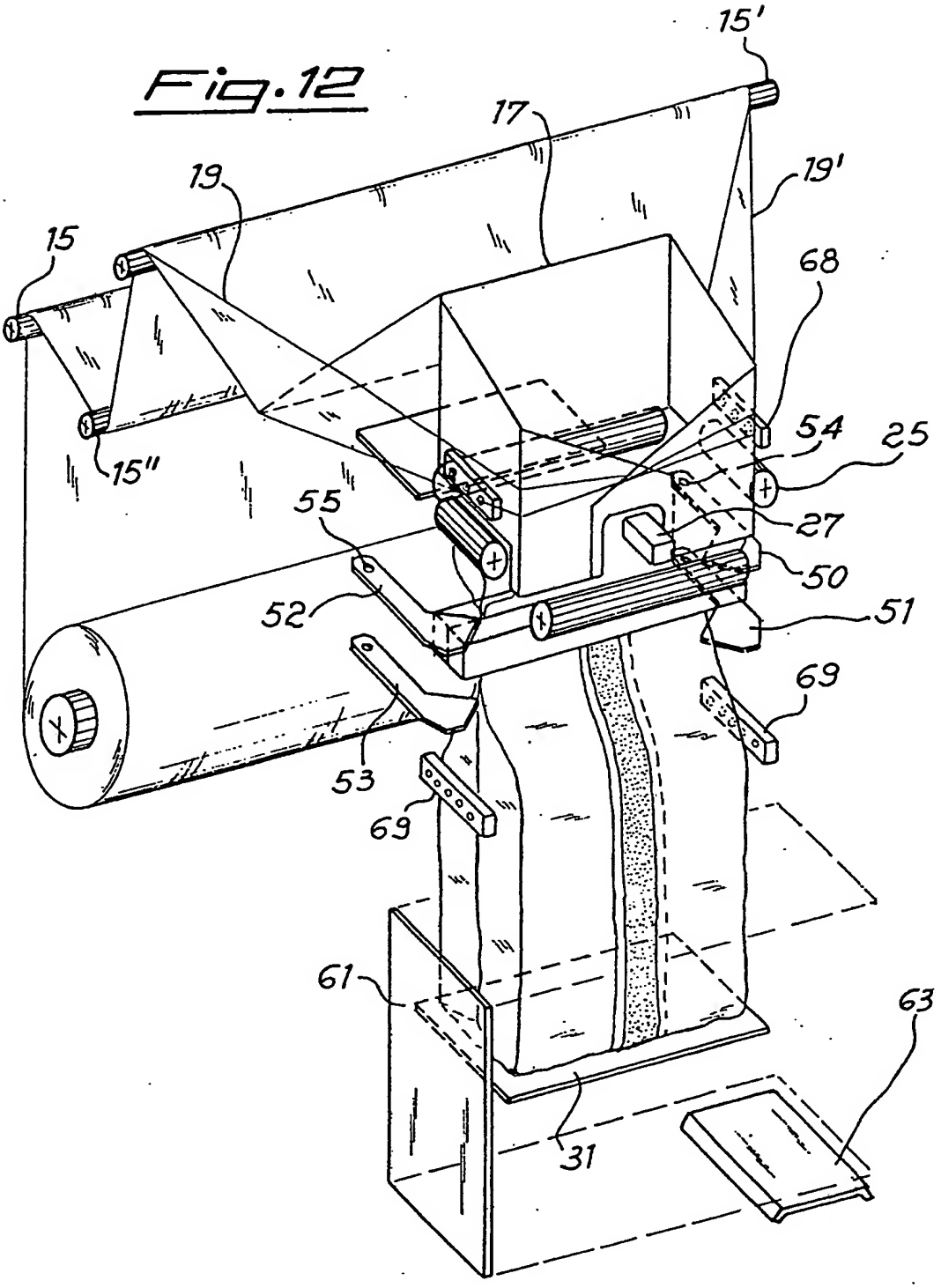


Fig.13

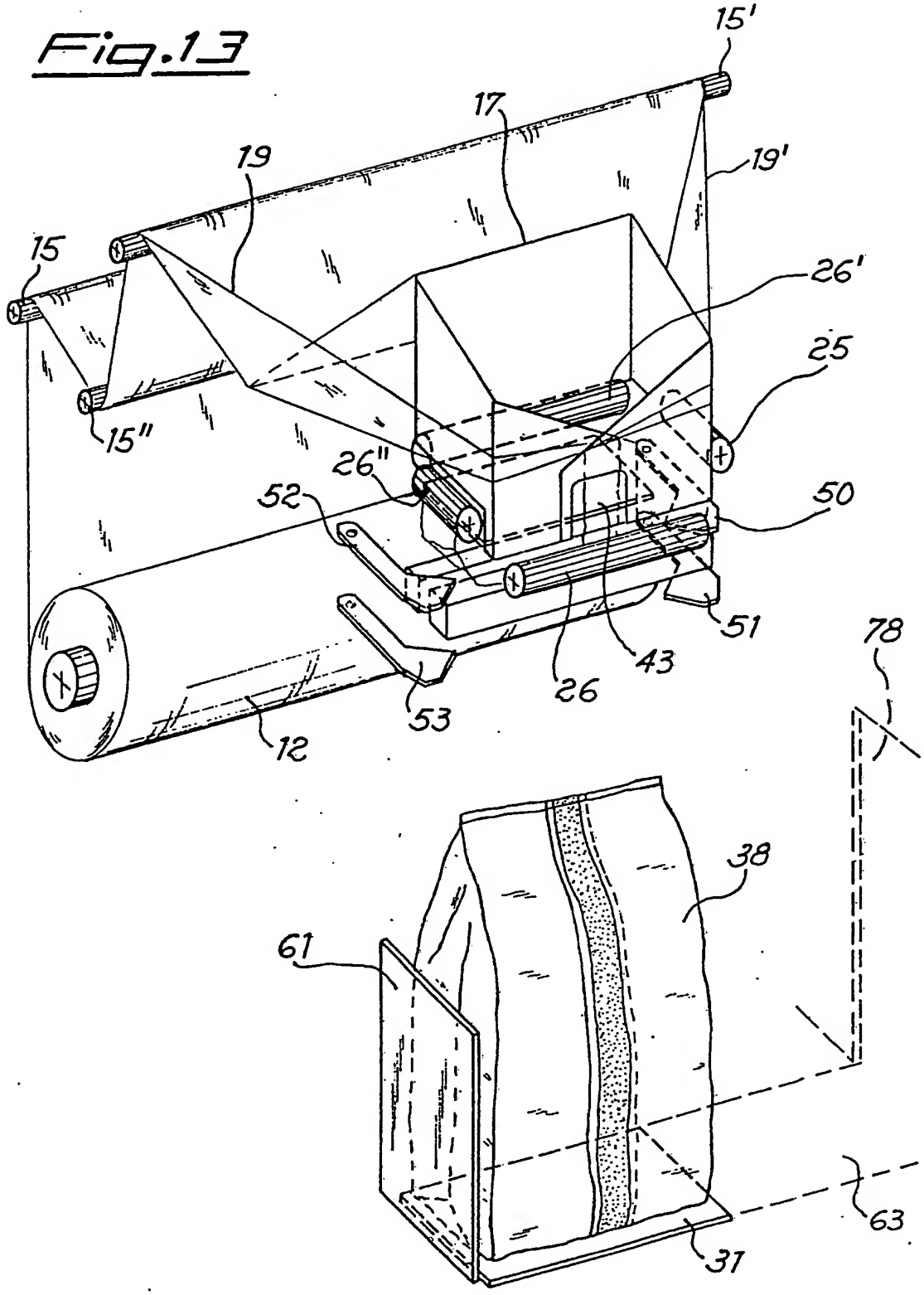


Fig.14

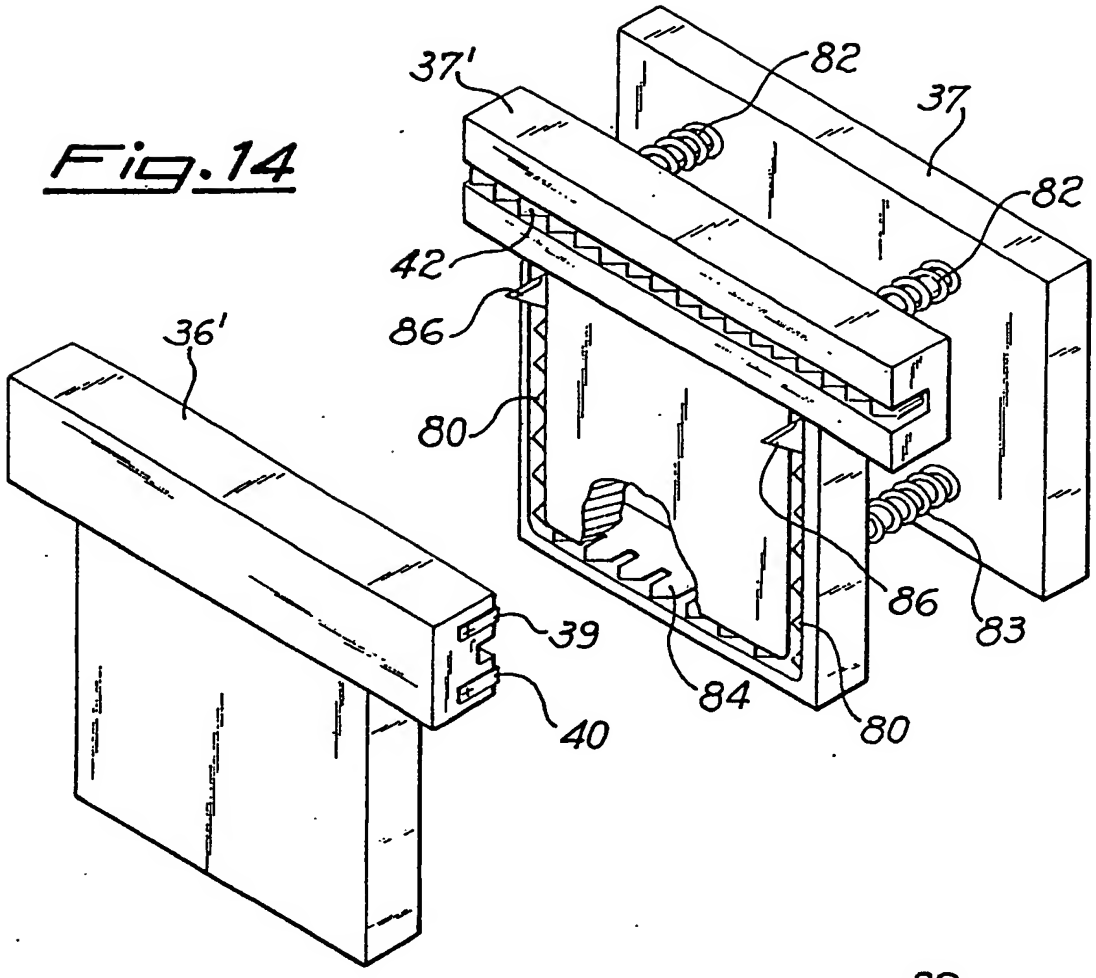

37'
82
37
82
42
86
36'
80
39
86
83
40
84
80

Fig.15

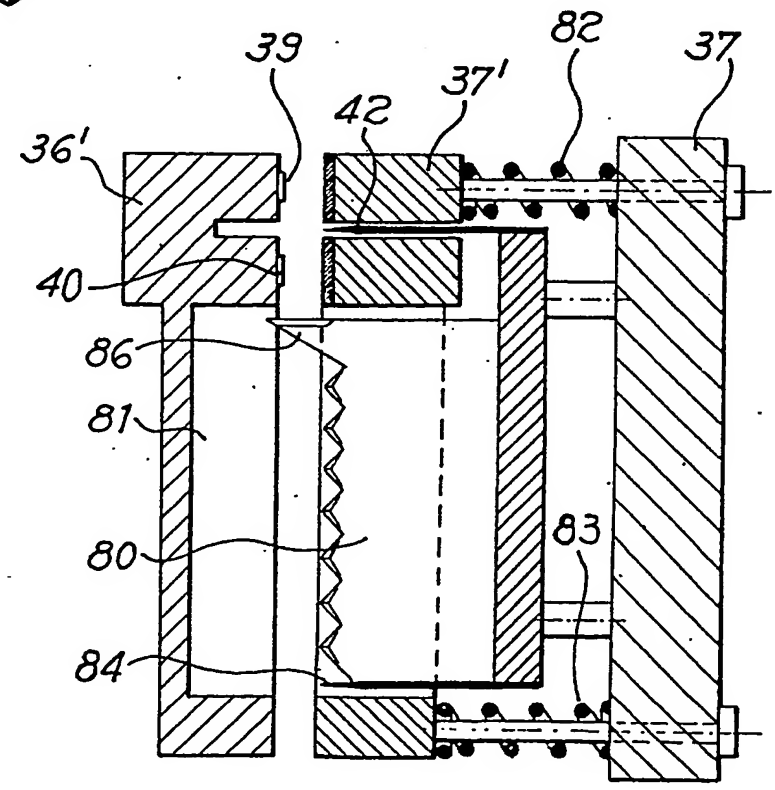

39
82
37
37'
42
36'
40
86
81
83
80
84

Fig.16

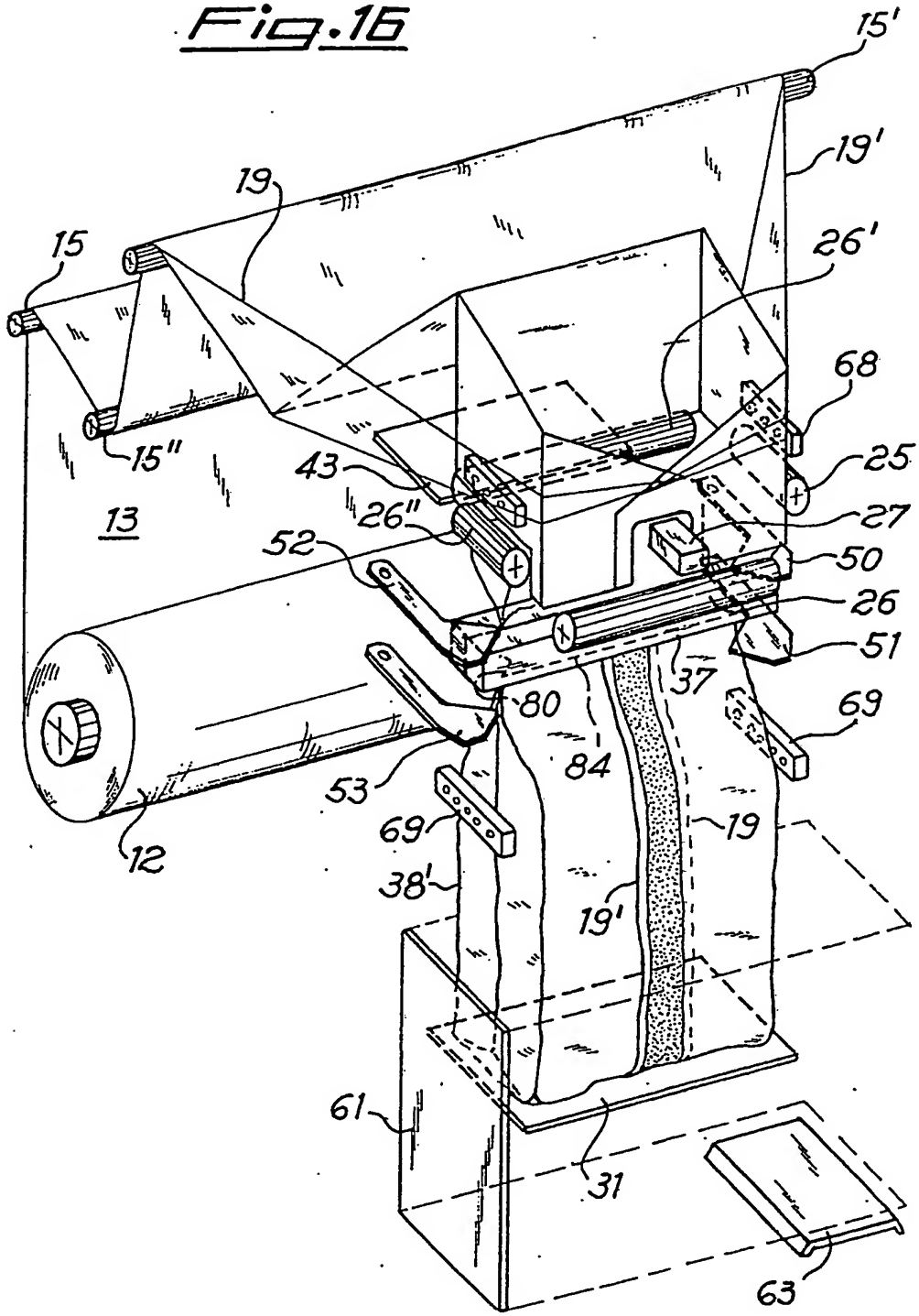
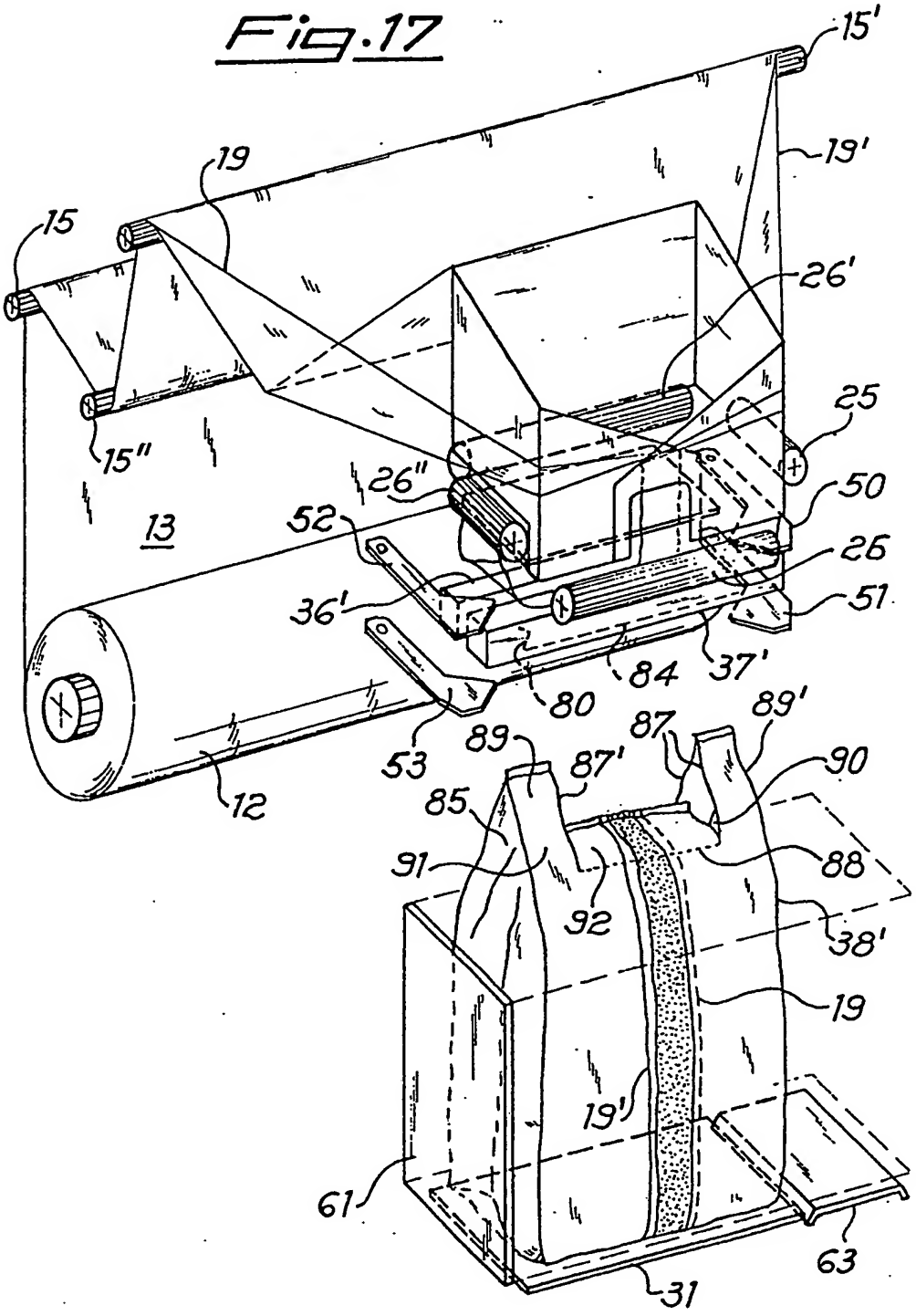

15'
19'
19
15
26'
68
15"
43
25
13
26"
27
52
50
26
51
37
80
69
84
53
19
69
38'
19'
61
31
63
12

Fig.17


15'
19
19'
15
26'
25
15"
26"
50
13
52
26
36'
51
37'
84
80
89'
87
89
87'
90
53
85
91
88
92
38'
19
19'
61
63
31
12

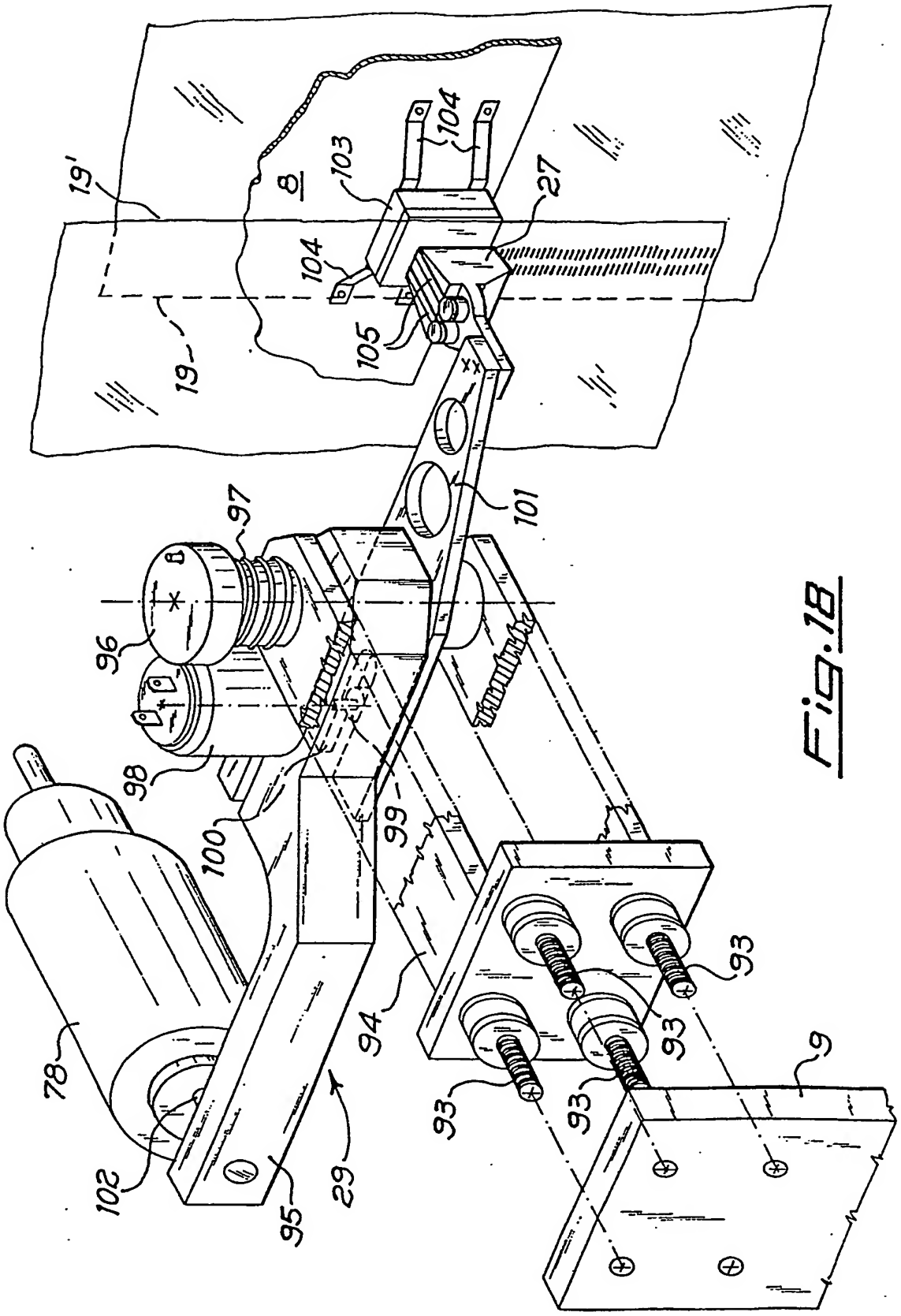

19'
8
103
104
27
104
105
19
101
97
96
98
100
99
94
93
93
93
93
9
78
102
95
29

Fig.18

Fig.19

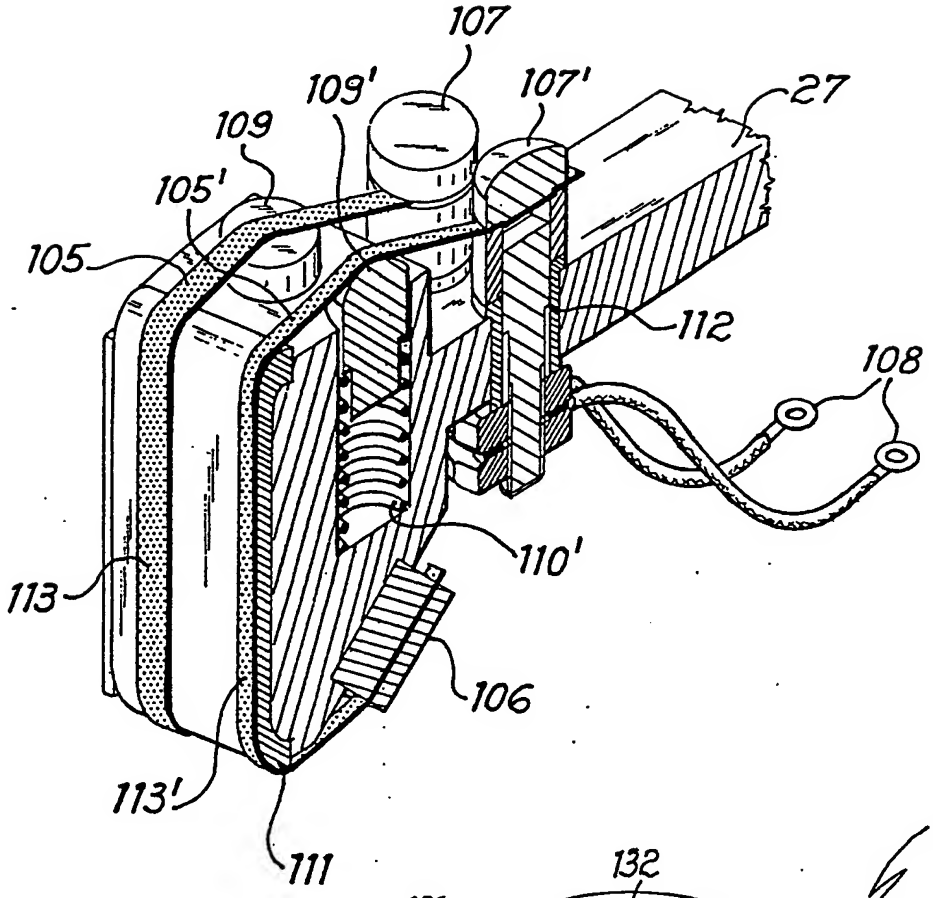
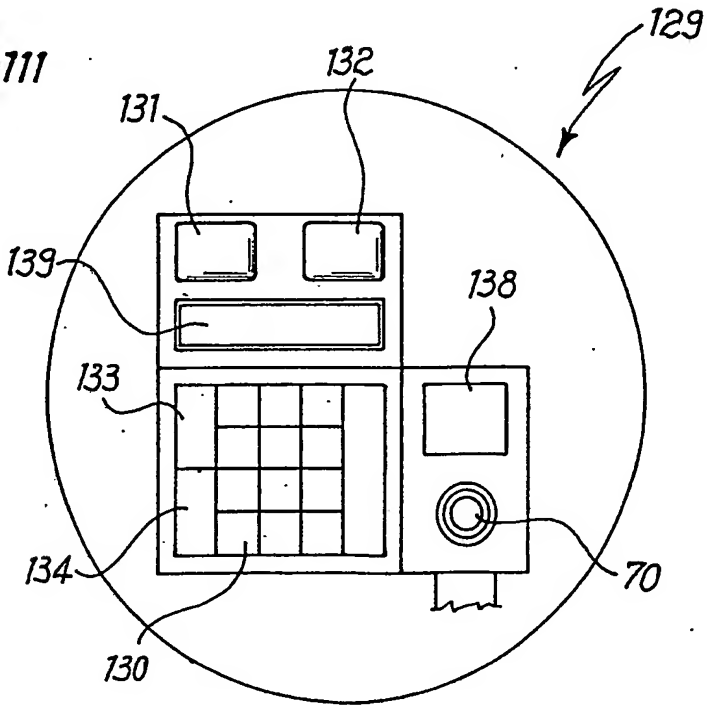

107
109'
107'
27
109
105'
105
112
108
110'
113
106
113'
111

Fig.21


129
132
131
139
138
133
134
70
130

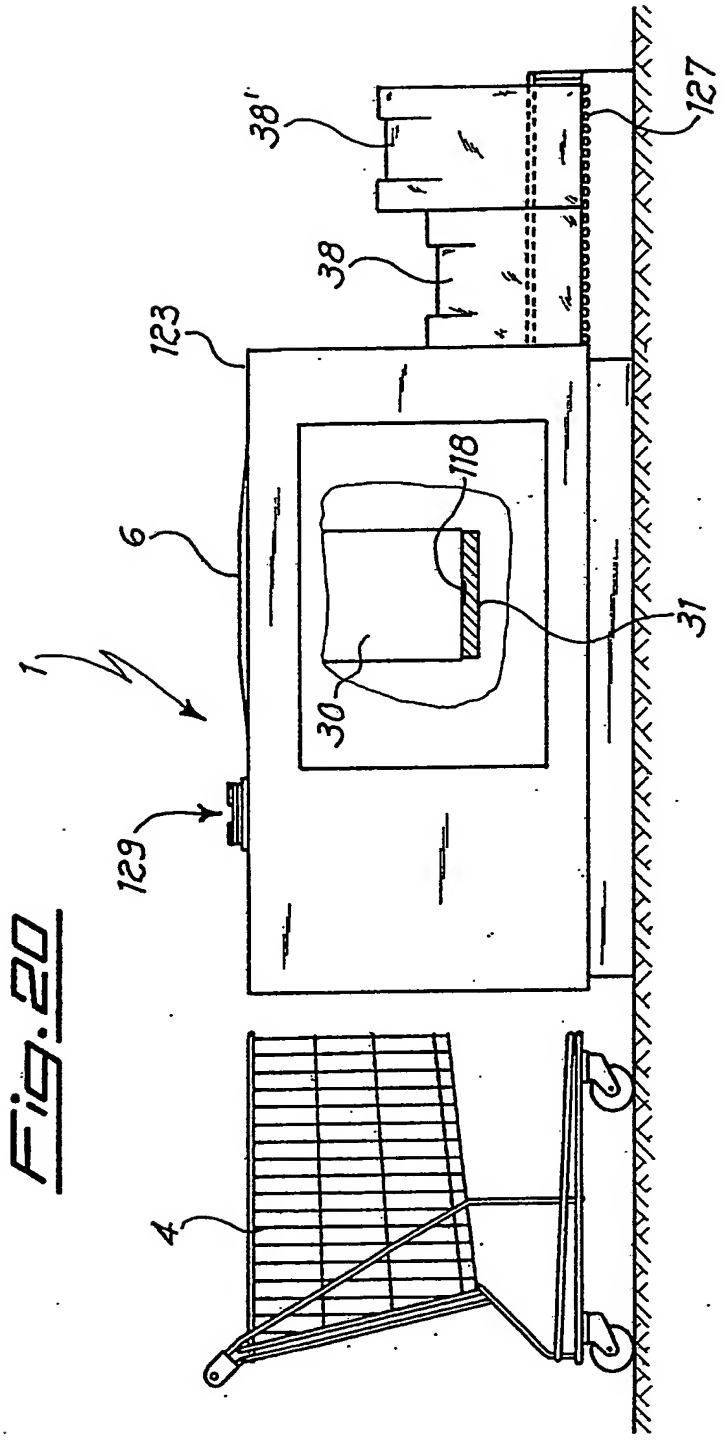


Fig.20

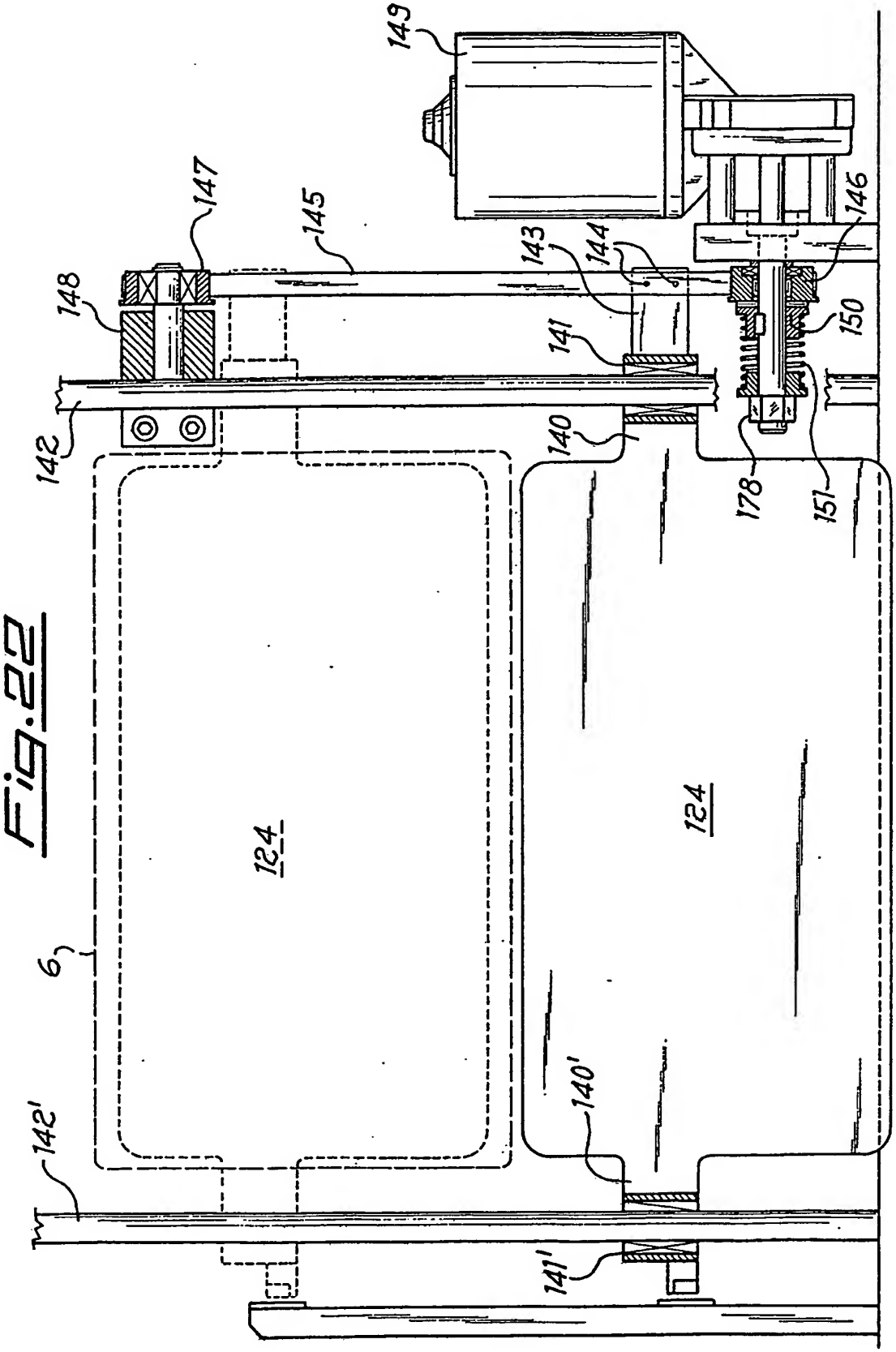

149
147
145
146
143
144
148
150
141
142
140
178
151
124
124
6
142'
140'
141'

Fig.22

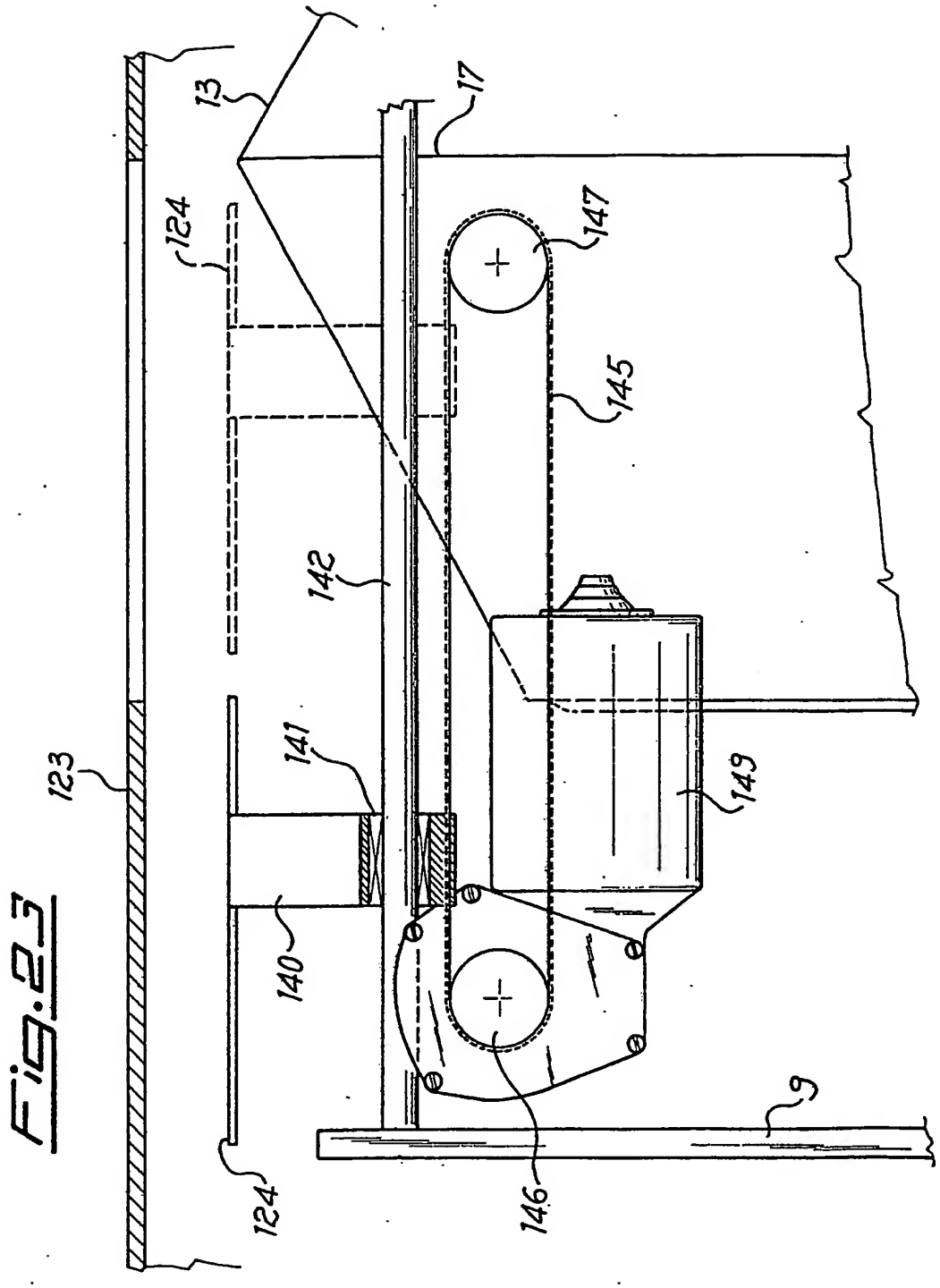
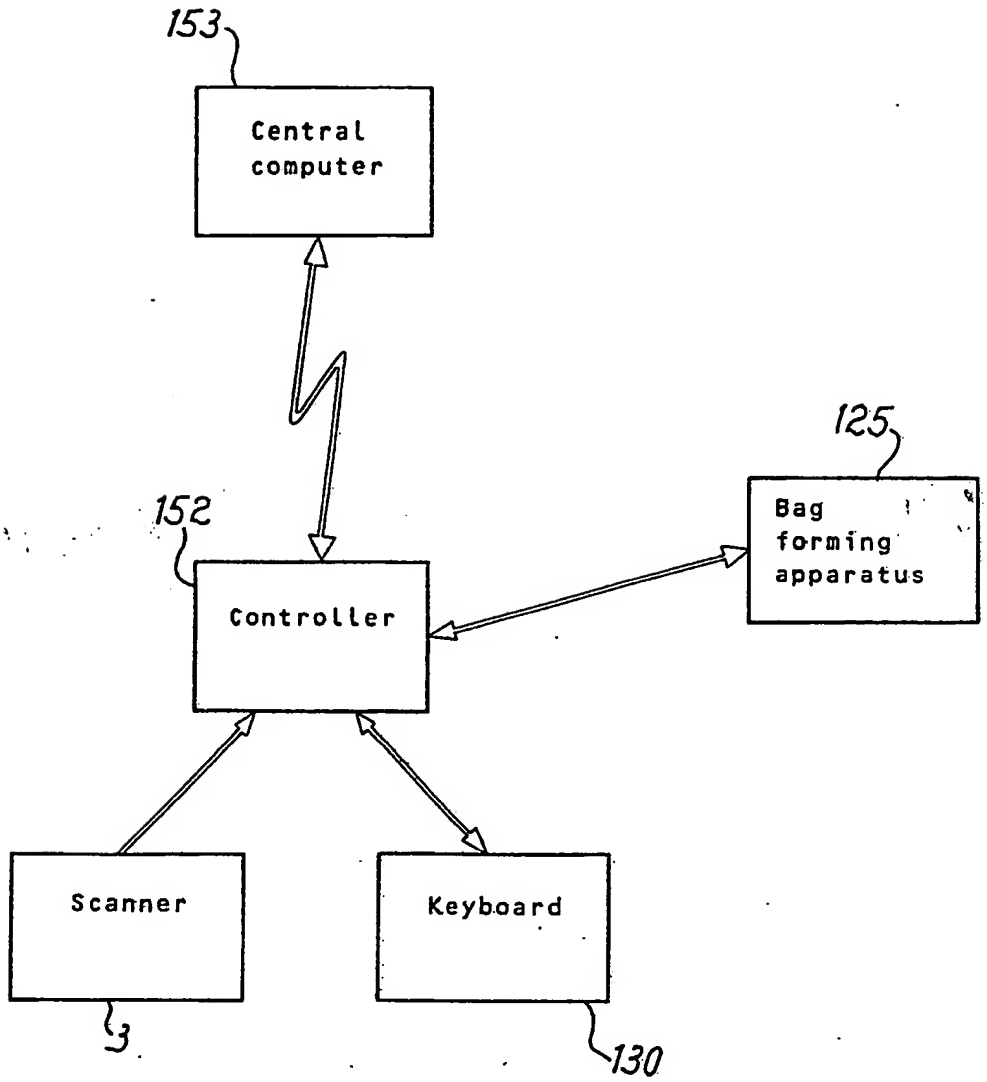


Fig.23

Fig.24


153
Central computer
125
152
Bag forming apparatus
Controller
Scanner
Keyboard
3
130

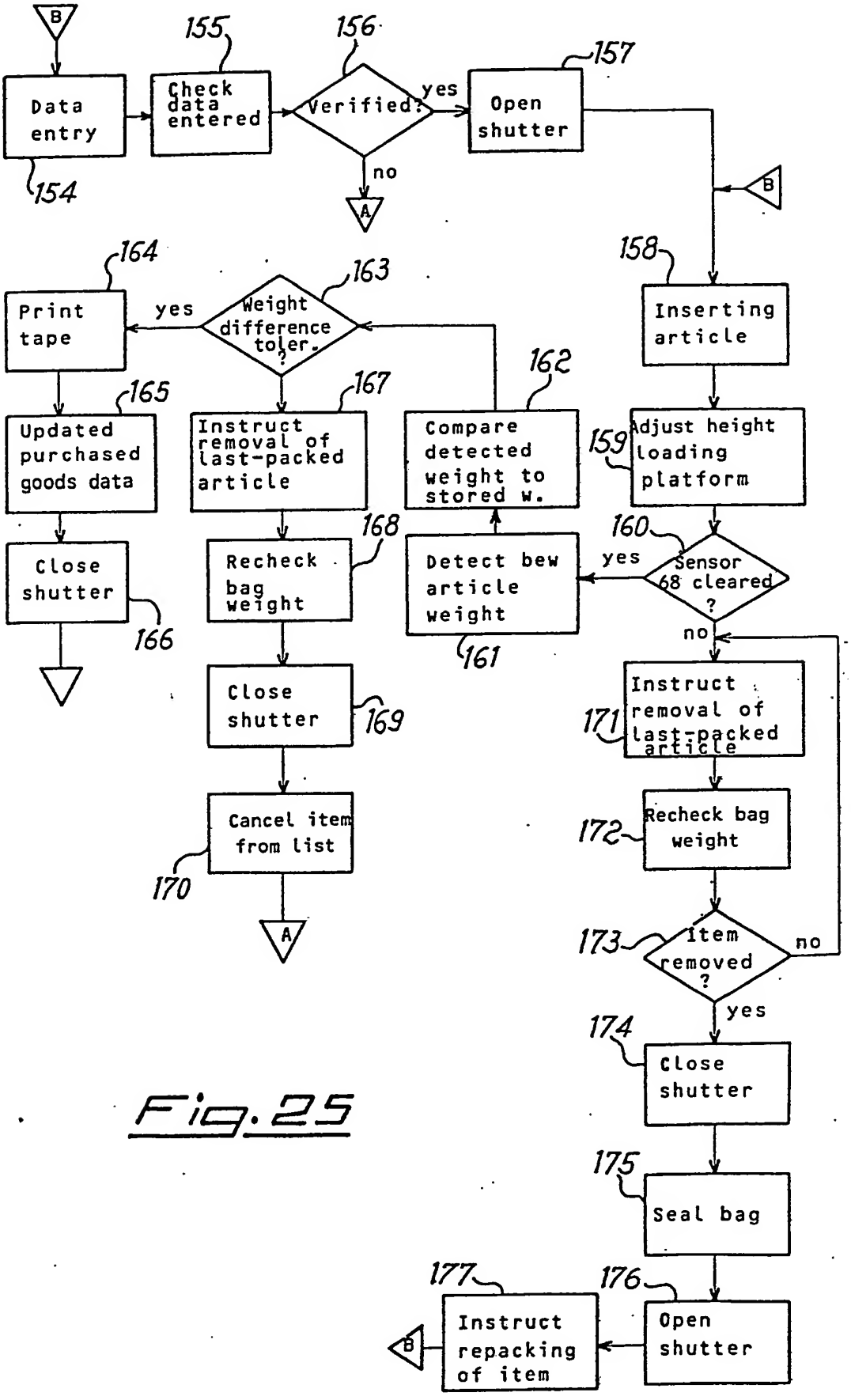

B
Data entry
154
155
Check data entered
156
Verified?
yes
no
A
157
Open shutter
B
158
Inserting article
159
Adjust height loading platform
160
Sensor 68 cleared ?
yes
no
161
Detect bew article weight
162
Compare detected weight to stored w.
163
Weight difference toler. ?
yes
164
Print tape
165
Updated purchased goods data
166
Close shutter
167
Instruct removal of last-packed article
168
Recheck bag weight
169
Close shutter
170
Cancel item from list
A
171
Instruct removal of last-packed article
172
Recheck bag weight
173
Item removed ?
no
yes
174
Close shutter
175
Seal bag
176
Open shutter
177
Instruct repacking of item
B

Fig. 25